United States Court of Appeals
for the
District of Columbia Circuit

TRANSCRIPT OF RECORD

801

No. 13945

JOINT APPENDIX (VOL. II)

United States Court of Appeals

FOR THE DISTRICT OF COLUMBIA CIRCUIT

April Term 1957

SHELL DEVELOPMENT COMPANY,
Plaintiff-Appellant
v.
ROBERT C. WATSON,
Commissioner of Patents,
Defendant-Appellee

United States Court of Appeals
For the
District of Columbia Circuit
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JOINT APPENDIX (VOL. II)

66 MR. BEALE: My next witness will be Mr. Smith.

Thereupon

LAUREL G. SMITH

67 was called as a witness by the plaintiff, and being first duly sworn was examined and testified as follows:

DIRECT EXAMINATION

BY MR. BEALE:

Q Mr. Smith, will you please state your name and residence?

A Laurel G. Smith, 13 Sherbrooke Road, Hartsdale, New York.

Q By whom are you employed, Mr. Smith?

A Shell Chemical Corporation, Agricultural Chemicals Division.

Q How long have you been employed by Shell Chemical Company?

A Eleven years.

Q Where are your present offices located?

A 460 Park Avenue, New York City.

Q Will you describe briefly the nature of your duties in your present office?

A I am Manager of the Distribution Operations Department. The primary function and responsibility of my department is to coordinate the production and inventories of our products in the Aldrin and Dieldrin; to assemble and prepare for management sales estimates.

We handle the distribution of the chemicals from the plant to our customers. In other words we process each order.

68 Q In connection with the performance of your duties is it necessary for you to know anything about the production of these agricultural chemicals and the forecast of production?

A Yes, because we, as I mentioned, coordinate our production with inventories and supplies.

Q In connection with the performance of your duties is it also necessary that you be familiar with the past sales records of the products sold by the Shell Chemical Company?

A Yes.

Q That is true in this field?

A Yes.

Q You mentioned I believe in answering me a few moments ago the expression Aldrin and Dieldrin. What are those names?

A They are generic names for insecticides which we market to control insect pests on agricultural crops.

Q How long did you say you had been in the New York office, Mr. Smith, in your present office?

A Approximately, well, just a little over a year.

Q Prior to that where were you located?

A In Denver, Colorado.

Q Over what period of time were you located in Denver?

A From August, 1952, until June, 1955.

Q And were you located at any plant or office
69 in Denver?

A Our offices were in buildings adjacent to the Denver plant.

Q Of what company?

A Of Shell Chemical Corporation.

Q And what was the nature of your duties while you were located in Denver?

A When I first went to Denver I was in the capacity of assistant manager of the Products and Sales Development Department. My responsibility at that time was primarily to evaluate results of field tests which were conducted in cooperation with state experiment stations and U. S. Department of Agriculture field research stations, and prepare and submit to the Registration Section of the U. S. Department of Agriculture labels covering the use of Aldrin and Dieldrin primarily, and to obtain acceptance of those labels so that we were permitted to ship in interstate commerce these products referred to for control purposes which were indicated on the label.

Following that period I became assistant to the Sales Manager, and my prime responsibility there was to spearhead, I guess you might say, the sales program in these various marketing fields.

Q Am I correct in understanding, Mr. Smith, that you are not a chemist?

70 A I am not a chemist.

Q While at the Denver plant of Shell Chemical Company did you become familiar with the manufacturing operations of the insecticides from a layman's viewpoint?

A Yes.

Q Will you state from the lay viewpoint what you know about the materials used in the manufacture of Aldrin?

A I know that a compound M101 was utilized in the manufacture of Aldrin and Dieldrin.

Q Do you know anything about the proportions of M101 by weight in Aldrin?

A Roughly it takes approximately .3 of a pound of M101 to produce one pound of Aldrin. Aldrin and Dieldrin can be converted approximately pound for pound.

Q You said that your duties required your familiarity with the sales of Aldrin and Dieldrin, and I am about to ask you a question about the magnitude of those sales. But first, Your Honor, I would like to make a very brief explanation.

There is a line of cases which we recognize wherein the courts have said that where a party such as this plaintiff has another patent or patents that are somewhat related to the economic situation, commercial success after the issuance of the patent does not have the weight as commercial success which occurred prior to the issuance of any patent when anyone was theoretically free to manufacture and compete.

71 The first patent which has any relation to this situation which was granted to plaintiff was granted on April 21, 1953. It relates to the manufacture of Aldrin, this insecticide.

I therefore attempted to anticipate the Patent Office possible argument and have taken a cut-off date of March 31, 1953, for the purpose of giving as nearly specific figures as we wish to give. That is why that date is being asked the witness.

THE COURT: The Patent Office has raised no issue.

MR. SCHIMMEL: The Patent Office has raised no issue as far as this is concerned.

MR. BEALE: I realize that; I understand that. I didn't know how the matter would arise, and I have prepared it this way.

BY MR. BEALE:

Q Mr. Smith, can you state of your own knowledge the pound production of this compound M101 that you have talked about up to the date of March 31, 1953? A In the period beginning 1949 and up until the date which you mentioned, namely, March 31, 1953, there were produced approximately 6 million pounds of M101.

Q Do you know of your own knowledge what proportion of that production went into the manufacture of Dieldrin and Aldrin? A All of it, sir.

72 Q Are you prepared to state whether or not the production of M101 since March 31, 1953, has been of the same, or greater, or lesser magnitude? A Since March 31, 1953, it has been of a greater magnitude.

Q Do you know of your own knowledge, Mr. Smith, the total dollar sales of Dieldrin and Aldrin which utilize this M101 up to March 31, 1953? A The sales of

Aldrin and Dieldrin during this period approximated seventeen and a half million dollars.

Q Are you prepared to state whether or not the magnitude of the dollar sales of Aldrin and Dieldrin since March 31, 1953, have been of lesser or greater or the same magnitude? A Of a greater magnitude, sir.

BY THE COURT:

Q What is M101?

MR. BEALE: M101, Your Honor, is the shorthand name given to the compound that is the subject matter of this suit.

BY MR. BEALE:

Q Mr. Smith, I believe you stated that it was part of your duties to work in conjunction with the county,
state, and federal officials in evaluating the usages
73 of Dieldrin and Aldrin as insecticides. Is that
correct? A Yes.

Q Can you state of your own knowledge anything about the magnitude of the cost to plaintiff of such cooperative work with these state and federal authorities? A Over an approximate four-year period the cost of development of Aldrin and Dieldrin for use as insecticides approximated one and a half million dollars. When I say "development" that covered developing through research, analytical methods, toxicology studies, labels, etcetera.

Q This was an expense incurred after the initial commercial manufacture and sale of Dieldrin and Aldrin? A Yes.

Q Of your own knowledge do you know anything about the variety of usages of Dieldrin and Aldrin with respect to the protection of crops. A Yes.

Q Will you give the Court some indication of how great that variety is? A Aldrin and Dieldrin are used in control of cotton pests which accounts for approximately 45 percent of the sale of insecticides in the domestic market today.

They are used for the control of a variety of pests attacking the roots of plants. We call them soil insects, such as corn root worms, wire worms, which not only reduce production but downgrade certain crops such as potato tubers.

74 They are used for the control of outbreaks of insects such as grasshoppers, and more recently an outbreak of the Mediterranean fruit fly in Florida which attacked citrus and other fruits.

They are used as household insecticides for the control of structural pests, such as termites.

They are also used more recently for the control of insect vectors of diseases affecting humans, such as malaria and filariosis. Briefly, that is it.

MR. BEALE: I shall ask that there be marked for identification as Plaintiff's Exhibit No. 8 a document entitled "Insecticide Recommendations," being Handbook No. AH103, U. S. Department of Agriculture, March 1956.

(U. S. Department of Agriculture Handbook No. AH103, March 1956, entitled "Insecticide Recommendations" marked for identification as Plaintiff's Exhibit No. 8)

MR. BEALE: I shall ask that there be marked for identification as Plaintiff's Exhibit No. 9 page 1698 of the Saturday, March 17, 1956, issue of the Federal Register.

(Page 1698 of March 17, 1956 issue of Federal Register marked Plaintiff's Exhibit No. 9 for identification.)

MR. BEALE: I shall ask that there be marked as Plaintiff's Exhibit No. 10 for identification pages 2464 and 2465 of the Federal Register issue of Tuesday, April 17, 1956.

75 (Pages 2464 and 2465 of Federal Register, April 17, 1956, marked Plaintiff's Exhibit No. 10 for identification.)

MR. BEALE: I am submitting photostats of each exhibit with the title page of the particular issue of the Federal Register.

BY MR. BEALE:

Q Mr. Smith, I shall ask you first whether or not you have known of any publication of the U. S. Department of Agriculture in which the use of Dieldrin and Aldrin as insecticides is recommended for use on crops and for a variety of insects. A I have knowledge of such publication. One is one issued by the U. S. Department of Agriculture, the Agricultural Research Division, in which it offers recommendations for the use of insecticides for the control of various crops. In those recommendations are recommendations for Aldrin and Dieldrin.

Q Is the document which I show you, which has been marked for identification as Plaintiff's Exhibit No. 8, such a recommendation as you have just described? A Yes.

Q I shall ask you whether or not you obtained this particular copy for me? A Yes.

76 Q And will you tell the source from which you obtained it? A We obtained it from the U. S. Department of Agriculture, or the U. S. Government Printing Office. I didn't obtain them myself but I asked someone to do it for me, and I am not certain which of the two sources they were obtained from.

Q But they are obtainable from both sources? A Yes, sir.

Q Within your knowledge? A Yes, sir.

MR. BEALE: I offer in evidence as Plaintiff's Exhibit No. 8 the Handbook which has been marked for identification by that number.

MR. SCHIMMEL: No objection.

THE COURT: Very well.

(The document heretofore marked for identification received in evidence as Plaintiff's Exhibit No. 8)

BY MR. BEALE:

Q Mr. Smith, do you know of your own knowledge whether or not there has been official action by the Department of Agriculture with respect to the acceptance of Dieldrin and Aldrin for use on certain crops including edible crops? A There has been, yes.

Q Do you know whether or not that acceptance
77 has been published in any Government publication?
A Yes.

Q In what publication? A In the Federal Register early for 1956 acceptances by the United States Department of Agriculture and the Food and Drug Administration were set forth in that, listing the crops and the tolerance for which Aldrin and Dieldrin had been accepted on food crops.

Q There has been marked for identification in this case as Plaintiff's Exhibits No. 9 and 10, respectively, copies of the two issues of the Federal Register. Are those the publications to which you have just testified? A Yes.

Q Mr. Smith, will you refer very briefly to the next to the last paragraph in the final column of each of these two published notices and tell me whether or not they state that any person who deems himself adversely affected may file a protest? That is true as to both of them, is it not? A Yes.

Q I shall ask you to state if you have any knowledge of any such protest having been filed at any time subsequent to the publication of these notices? A To my knowledge no protest has been filed.

Q And the effective dates of the two orders were
March 17, 1956, and April 17, 1956, respectively?
78 A That is correct, yes, sir.

MR. BEALE: I offer in evidence as Plaintiff's Exhibits 9 and 10 the portions of the Federal Register previously marked for identification.

MR. SCHIMMEL: No objection.

THE COURT: Very well.

(The documents heretofore marked for identification received in evidence as Plaintiff's Exhibits 9 and 10)

BY MR. BEALE:

Q Mr. Smith, have you any knowledge with respect to any recent order for large amounts of Dieldrin and Aldrin placed by or through the Federal Government or any agency thereof? A As I mentioned before, Dieldrin is used in the anti-malarial control program in a number of countries outside of the United States; Indonesia being one of them, and this year the International Cooperative Administration through General Services Administration ordered bids for 1,800,000 pounds of Dieldrin 50 percent wettable powder amounting to approximately 900,000 pounds of Dieldrin.

Q Do you know whether or not those bids were supplied and accepted? A Yes, they were.

Q I shall ask you, Mr. Smith, if within your own knowledge you can state whether or not in every
79 pound of Dieldrin and Aldrin covered throughout your testimony there has been used some portion of this compound M101? A Yes. Aldrin and Dieldrin couldn't be produced without M101.

Q All of the Aldrin and Dieldrin sold by plaintiff has utilized M101 in the manufacture of those two insecticides? A Yes.

Q And in the proportions I think you said of slightly better than 30 percent of the ultimate weight of the compound, or .3? A About .3 of a pound of M101 is equivalent to one pound of Aldrin.

MR. BEALE: Direct examination closed.

MR. SCHIMMEL: I have no questions.

THE COURT: That is all.

(The witness left the stand.)

• • • •

26 MR. SCHIMMEL: If I may illustrate. For example, Your Honor, if you will turn to Item C in our folder, on the last page of that item, Table 4, concluded; the third compound in the middle column shows this structure which is the structure of the material of Claim 13 with 1 hydrogen here substituted by COOH. That probably is the closest approach to the claim compound that we have, as I see the publication. The Ring structure contained in that compound is what Ring characterizes as the Ring structure. It is not the identical compound, true enough, in the Ring publication.

* * * *

Pl's Exh. 1
MAIL DIVISION
1 August 21, 1948
U. S. PATENT OFFICE

* * * *

SPECIFICATION

TO ALL WHOM IT MAY CONCERN:

Be it known that we, Julius Hyman, and Ernest Freireich, and Rex E. Lidov, citizens of the United States, residing, respectively, at Box 2171, Denver, in the County of Denver, and State of Colorado, and at 405 Josephine, Denver, in the County of Denver, and State of Colorado, and at 800 Adams Street, Denver, in the County of Denver, and State of Colorado, have jointly invented certain new and useful improvements in

DIENIC HYDROCARBONS AND DERIVATIVES THEREOF

of which the following is a specification:

2 This invention relates to new compositions of matter and methods and processes for their preparation.

More specifically, this invention relates to unsaturated hydrocarbons and certain of their derivatives neither heretofore known nor known to be capable of existence, possessing unique reactivities and valuable in themself and as intermediates in the synthesis of a large number of valuable new pure chemicals and polymers.

One object of this invention is the preparation of new unsaturated hydrocarbons.

Another object of this invention is the production of insecticidally active hydrocarbons.

Another object of this invention is th eproduction of hydrocarbons possessing valuable characteristics in the preparation of stable, highly active halogenated insecticides.

Still another object of this invention is the preparation of unsaturated hydrocarbons useful for the production of a variety of polymeric materials.

Further objects of this invention are the methods and processes to be employed in producing these valuable unsaturated hydrocarbons and their derivatives.

A still further object is the provision of a continuous process for producing the new compositions of matter comprehended by this invention.

Other objects, features, capabilities and advantages are comprehended by the invention, as will later appear and as are inherently possessed thereby.

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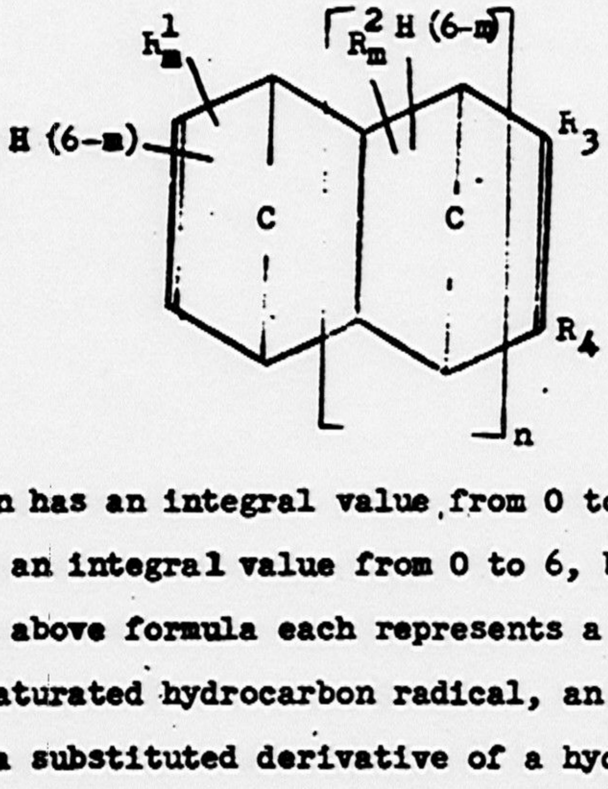
Other objects, features, capabilities and advantages are comprehended by the invention, as will later appear and as are inherently possessed thereby.

The Diels-Alder diene synthesis is well known and has proved applicable for the preparation and manufacture of a large number and variety of compounds. In general many kinds of dienes, reacting with a great diversity of unsaturated compounds have been employed for this purpose. Specifically, the reaction of non-cyclic dienes with some acetylenic hydrocarbons is known. Except, however, in a very limited number of cases of a special class, to be defined hereinafter, the reaction of cyclic dienes, such as cyclopentadiene, and its derivatives, with acetylenes has not heretofore been accomplished.

We have now discovered conditions such that cyclopentadienes and substituted cyclopentadienes can be readily caused to react with acetylene and its derivatives to produce compounds possessing the following probable structural formulae:



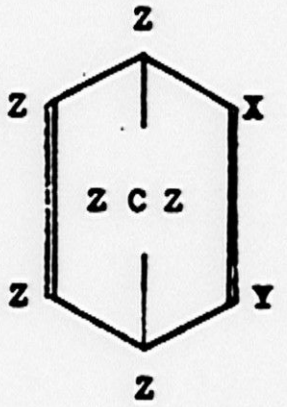
in which n has an integral value from 0 to 3, both inclusive, and m has an integral value from 0 to 6, both inclusive. R_3 and R_4 in the above formula each represents a hydrogen atom, a halogen atom, a saturated hydrocarbon radical, an unsaturated hydrocarbon radical, a substituted derivative of a hydrocarbon radical or a substituted derivative of an unsaturated hydrocarbon radical;

4 they may be identical with or different from each other and identical with or different from R^1 and R^2. R_3 and R_4 are not to be taken to represent carboxy or carboxy-ester groups nor are they to be taken to represent radicals bearing ketone oxygen on the carbon attached to the ring system.

The symbols R^1m and R^2m, where m may range over an integral value from 0 to 6, both inclusive, represent substituents in the pentacarbon cycles selected from the group consisting of hydrogen atoms or R radicals. R as here used is defined as a saturated or unsaturated alkyl, alkylidene, cycloalkyl, cycloalkylidene, aryl radical, or a substituted derivative thereof. More than one R type substituent may be present attached to the carbon atoms of the pentacarbon cycle, the number of groups so attached being defined by the integral value of m, except that when one of the groups is an alkylidene or cycloalkylidene group the total number of groups present is defined as (m-1). Since, in these rings, each carbon atom must be attached either to a substituent, as previously defined, or to a hydrogen atom, the number of hydrogen atoms remaining attached to carbon atoms in each pentacarbon ring is given by the value (6-m). The R type groups may arise through the use of substituted cyclopentadienes and similarly, through the use of fulvenes.

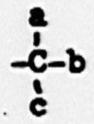
As previously indicated, R_3 and R_4 may also represent halogen atoms selected from the group of chlorine, bromine and iodine which arise in the molecule through the use of appropriately halogenated acetylenes in the reaction with cyclopentadiene or substituted cyclopentadienes.

In many cases, the new compositions of our invention can be more simply represented by the following structural formula:



In this formula the Z's represent hydrogen atoms, halogen atoms or R radicals, R being here used in the same sense as hereinbefore defined for R^1_m and R^2_m. Each of the Z's is independently selected and they may therefore represent similar atoms and radicals or different atoms and radicals taken from the above defined group. Of course, only the methano bridge carbon atom can carry an alkylidene type substituting group and, when this is the case, both of the two groups shown in the above formula as attached to the methano bridge carbon must, together, be considered to represent the alkylidene radical.

The symbols X and Y represent radicals independently selected from a group of monovalent atoms and radicals consisting of H, -Cl, -Br, -I, $-R^1$, -OR, -SR, $-N(R)_2$, $-N(R)_3^{+}$, $-CH_2OH$, $-CH_2SH$, and T. The symbol R as here used has the value hereinabove defined, and the symbol R^1 is defined as a saturated or unsaturated hydrocarbon radical. The radicals represented by T are those defined by the formula



$$-\overset{\overset{\displaystyle a}{|}}{\underset{\underset{\displaystyle c}{|}}{C}}-b$$

in which a, b and c represent attachments to all of the free bonds of the radicals selected from the group -H, -R, -Cl, -Br, -I, -OR, -SR, $-NR_2$, $-NR_3^{+}$, $-CH_2-(CH)_n-CH_2-$, =CH-CH=CH-CH=CH-, the unsaturated and substitution derivatives of $-CH_2-(CH_2)_n-CH_2-$ and the substitution derivatives of =CH-CH=CH-CH=CH-. R is again used in its previously defined sense.

6 It is clear that when the radical selected is of the type $-CH_2-(CH_2)n-CH_2-$ the group attached to the acetylenic carbon is a cyclo-alkyl type group and, when the radical selected is of the type $=c-c=c-c=c-$, the group joined to the acetylenic carbon of an acetylene is aryl in character.

These new compounds of our invention are prepared by causing a cyclopentadiene, or a substituted cyclopentadiene, to react with acetylene, or a substituted acetylene, in a Diels-Alder type reaction under appropriate conditions.

The compounds represented by the structures hereinbefore indicated represent bicyclo-(2.2.1)-2,5-heptadiene and derivatives thereof. In view of the state of knowledge in the art prior to the present invention, the fact that the limited number of cyclo-substituted acetylene reaction products (herein previously noted) known to exist were unstable, was generally viewed as substantiating the belief that the bicycloheptadiene system involved was an unstable, or highly strained, system. In view of these beliefs, it was suggested that the few known examples of carboxy, carboxy ester and acyl substituted derivatives of the general class represented a special case in which a normally highly unstable system was made capable of isolation because of the stabilizing effect of the conjugated oxygen double bonds introduced by the substituent groups. The actual instability of these derivatives, confirming as it did the belief that the system was intrinsically unstable, made it appear to be illogical, unwarranted and in contradiction to the teachings in the art to suggest that simple bicyclo-(2.2.1)-2,5-heptadienes or unstabilized derivatives thereof might be prepared. This general point of view was apparently substantiated
by the failure of the usual elimination reactions,
7 which normally might be expected to produce bi-
cyclo-(2.2.1)-2,5-heptadiene from 5-chloro- or 5-

hydroxybicyclo-(2.2.1)-2-heptene under the usual reaction conditions, to yield the expected compound. In view of these facts, our discovery that simple bicycloheptadienes such as we have now prepared can exist and, in fact be prepared without undue difficulty is both novel and unexpected.

Our new bicycloheptadienes can be prepared by reacting together acetylenes and cyclopentadienes in appropriate ratios at temperatures ranging from 150° C to 400° C and at pressures ranging from atmospheric, or a few pounds above atmospheric, to pressures of approximately 250 pounds per square inch gauge for predetermined reaction times in both static and dynamic systems, depending on the physical nature and chemical reactivity of the reactants and the reaction products. A static system as the term is here used is one in which the reactants are combined in a system at atmospheric pressure under reflux or at pressures above atmospheric in a closed vessel and reacted together for such period of time as is required to complete the desired reaction. A dynamic system which, generally, is the method of choice, as the term is here used, is one in which the reactants, properly prepared, are caused to flow through a reaction zone maintained at a predetermined temperature and pressure.

The reactions may be carried out in the presence or absence of solvent. Suitable solvents which will, of course, be selected in accordance with the reaction conditions employed may, for example, be ketones, alco-
8 hols, hydrocarbons, etc., in various boiling ranges
and, more specifically may be such solvents as ethanol, ethyl methyl ketone, heptane, benzene, xylene, polyalkylated naphthalenes, the commercial mixture of diphenyl ether and diphenyl available under the trade name "Dowtherm" and the like.

We have found that it is frequently desirable when carrying out the reaction by static processes to add to the reaction mixture a small amount of a polymerization inhibitor such as a hydroquinone to prevent polymerization of the dienic constituent.

It is important that the temperature and pressure conditions for the reactions be adjusted to prevent decomposition and loss of the reactants and the product. Thus, the reaction of cyclopentadiene with acetylene is generally more desirable when carried out in a dynamic system, since the solubility of acetylene in almost all liquids is relatively low at elevated temperatures unless high pressure is employed. It is well known, however, that acetylene decomposes with explosive violence when subjected simultaneously to both elevated pressures and elevated temperatures. Accordingly, this reaction is best accomplished in a flowing vapor phase or mixed phase system. On the other hand, the reaction of *octyne* with cyclopentadiene or of *phenyl acetylene* with cyclopentadiene can be accomplished in a simple batch system, inasmuch as the necessary temperature for reaction can readily be attained without the development of unduly high partial pressure of the acetylenic component above the reaction mixture.

The new compounds which we have discovered and the processes for preparing them can best be illustrated by means of specific examples. It is understood that the examples which follow are illustrative only and are not to be taken as limiting the scope of our invention.

EXAMPLE I

F E E Insert E' E

Bicyclo-(2.2.1)-2,5-heptadiene can be readily prepared by passing cyclopentadiene and acetylene in mole ratios between one to one. ~~[illegible]~~ and to ten through a hot reaction zone maintained at a temperature between 250 and 375° C and at a suitable pressure at such a rate as to E' provide the necessary reaction time period lying between about one and about fourteen minutes. The vapors issuing from the reaction zone are condensed and the desired Diels-Alder reaction product is obtained by fractionation from the recovered liquid. Table I, which follows, illustrates the results obtained.

TABLE I

A	B	C	D	E	F	G
Run No.	T°C	Abs. Press. P.S.I.	Mole C_2H_2‡ to moles C_5H_6■	Reaction time min.	%1:1 C_5H_6■-C_2H_2‡ adduct based on wt C_5H_6■ charged	wt C_5H_6■ utilized
177	319	39	1.46	4.5	7.6	9.4
157	320	80	1.43	1.9	9.9	14.0
163	314	103	0.91	4.7	12.6	14.5
151	343	80	1.98	2.0	25.0	32.0
190	288	80	1.60	5.7	3.7	4.2
193	259	80	2.1	14.	7.6	12.3

‡ Acetylene

■ Cyclopentadiene

The isolated product of columns F and G is a mobile liquid of characteristic odor (which suggests both chloroform and

10 benzene) boiling between 83-84° C at pressures between 620-635 mm mercury, with a refractive index ranging between 1.4685 and 1.4720 at 20° C and having a density between 0.8770 and 0.9100 at 20° C. Analysis of this material gives the following results:

C: 91.10% H: 8.80% Mol. wt: 92.4

Calculated for the 1:1 cyclopentadiene-acetylene adduct, C_7H_8

C: 91.25% H: 8.75% Mol. wt: 92.13

The isolated material, while it may not be completely pure, consists essentally of bicyclo-(2.2.1)-2,5-heptadiene. This is evident from the fact that low pressure hydrogenation of the product over a Raney nickel catalyst yields, with the absorption of two moles of hydrogen, the known bicyclo-(2.2.1)-heptane.

As hereinbefore previously indicated, the formation of bicyclo-(2.2.1)-2,5-heptadiene can also be effected in the presence of a solvent. This is illustrated by the data of example II.

EXAMPLE II

Cyclopentadiene, acetylene and a commercial mixture of diphenyl ether and diphenyl are caused to flow together through a heated reaction zone, maintained at a suitable pressure at such a rate as to provide the necessary reaction time. The vapors issuing from the reaction zone are condensed and the desired Diels-Alder reaction product is obtained by fractionation from the recovered liquid. In this experiment the reaction zone was in the form of a metal vessel maintained at the desired temperature by immersion in a heated salt bath. At the start of the experiment a portion of the space in the reaction zone was filled with the solvent mixture, and a weight of solvent equal to the weight of cyclopentadiene pumped was caused to flow continuously into the reaction zone with the reactants. Table II summarizes the results obtained.

TABLE II

A	B	C	D	E	F	G
					% 1:1 $C_5H_6^{\blacksquare}$-$C_2H_2^{\ddagger}$ adduct based on	
Run No.	T° C	Abs. Press. P.S.I.	Mole $C_2H_2^{\ddagger}$ to moles $C_5H_6^{\blacksquare}$	Reaction time min.	wt $C_5H_6^{\blacksquare}$ charged	wt $C_5H_6^{\blacksquare}$ utilized
197	291	80	1.78	8	27.3	39.2

‡ Acetylene

■ Cyclopentadiene

It will also be expected that the yields of product obtained will vary with the magnitude of the scale on which the preparations herein described are carried out: in general, better conversions are to be expected in commercial operations than are obtained in laboratory experiments.

Thus, in pilot plant operations under conditions nominally similar to those listed in Run No. 151 of Table I above, except for a somewhat higher ratio of acetylene to cyclopentadiene and for a somewhat longer reaction time, yields of the 1:1 reaction product as high as 60-65 wt. per cent, based on the weight of cyclopentadiene charged have been obtained. These yields, based on the weight of cyclopentadiene utilized are, of course, even higher.

It is clear that the conditions under which bicyclo-(2.2.1)-2,5-heptadiene can be produced can be varied with resultant changes in the yields of product obtained. Those skilled in the art will at once recognize that each set of conditions selected will possess its own peculiar advantages and disadvantages. The conditions hereinabove set forth are, therefore, presented only to illustrate some of the ways in which the new compositions of our invention, and more particularly bicyclo-(2.2.1)-2,5-heptadiene, can be prepared and they are not to be taken in any way to limit the scope of our invention which necessarily includes other operating conditions which, in view of our basic teaching, will be readily apparent to those skilled in the art.

Many new compositions of matter are, of course, now obtainable as a result of our basic discovery. ~~This is further~~ illustrated by Example III which demonstrates not only the preparation of a bicyclo-(2.2.1)-2,5-heptadiene, but also another process by which the new compositions of our invention may be prepared.

EXAMPLE III

Into a metallic reaction vessel capable of withstanding moderate internal pressures was placed 273 grams of hexachlorocyclopentadiene and acetylene was then passed into the reactor until the pressure reached 35 pounds per square inch gauge. The reactor was then heated to 180° C for a four hour period, at the end of which the pressure had risen to 160 pounds per square inch gauge. The reactor was vented (some hydrogen chloride was noted in the waste gases) and the vessel was repressured with acetylene to a pressure of 62 pounds per square inch gauge. The reactants were further heated for one hour.

The reaction mixture, which consisted of a viscous black liquid, was then removed from the reactor. 126 grams of

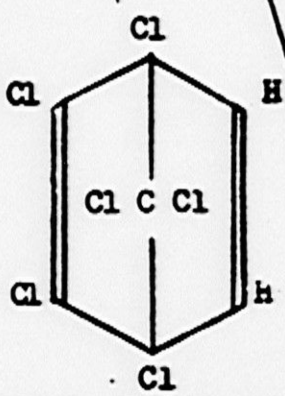
~~hexachlorocyclopentadiene was recovered by distillation from the reaction mixture. The black residue, which solidified, was taken up in hexane, treated with carbon to effect decolorization, filtered and chilled. A brown solid was thus obtained which was collected on a filter and then recrystallized from heptane.~~

~~By this procedure a white crystalline solid melting between 332-334° C was recovered.~~

~~Analysis gave the following results:~~

~~Cl, 71.32%: Calculated for $C_7H_2Cl_6$; Cl, 72.9%~~

~~The compound is thus the expected one to one adduct of hexachlorocyclopentadiene and acetylene, 1,2,3,4,7,7-hexachlorobicyclo-(2.2.1)-2,5-heptadiene with the probable structural formula, or a polymer thereof:~~

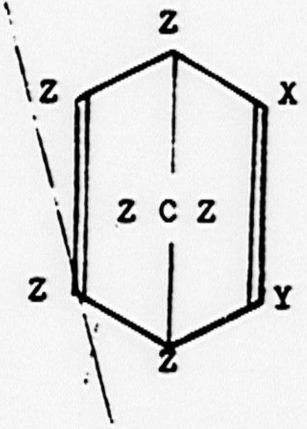


These new compounds of our invention are highly valuable as chemical intermediates for the preparation of insecticides, plasticizers, plastics, solvents, and a variety of fine chemicals useful in themselves and further as chemical intermediates. These new compounds may also be themselves useful directly as insecticidal agents, solvents, and placticizers. Certain of them have usefulness as raw materials for the manufacture of surface coating ingredients and high explosives.

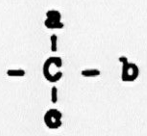
14 Those skilled in the art will readily recognize the possibility of minor modifications in the nature of the reaction components and in the methods employed for carrying out these reaction processes. Such modifications and the many new compounds which can be prepared as a result of our basic discovery are properly to be included within the scope of our basic discovery, which is to be limited, not by the illustrative examples herein present, but only by the hereinafter appended claims.

IT IS CLAIMED:

1. As new compositions of matter, compounds possessing the following structural formula:



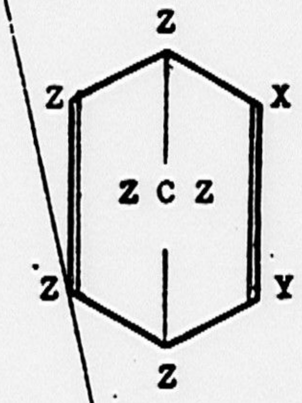
wherein each of the Z's is selected, independently of each other, from the group consisting of H, -R, and halogen atoms, R defining a saturated or unsaturated hydrocarbon radical or a substituted derivative of a saturated or unsaturated hydrocarbon radical, and wherein X and Y are independently selected from a group consisting of H, -Cl, -Br, -I, -R', -OR, -SR, $-N(R)_2$, $-\overset{+}{N}(R)_3$, $\underset{H_2}{C}-OH$, $\overset{H}{\underset{H}{C}}-SH$ and T, R having the value previously defined, R' being defined as a saturated or unsaturated hydrocarbon radical, and T being defined as the radicals represented by the formula



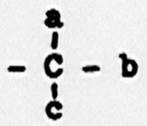
$$-\overset{a}{\underset{c}{C}}-b$$

in which a, b, and c represent attachments to all of the free bonds of the radicals selected from the group -H, -R, -Cl, -Br, -I, -OR, -SR, $-N(R)_2$, $-\overset{+}{N}(R)_3$, $-CH_2-(CH_2)_n-CH_2-$, =CH-CH=CH-CH=CH-, the unsaturated and substitution derivatives of $-CH_2-(CH_2)_n-CH_2-$ and the substitution derivatives of =CH-CH=CH-CH=CH-.

2. As new compositions of matter, compounds obtained from the reaction of an acetylene with a cyclopentadiene in a Diels-Alder reaction and possessing the following structural formula:



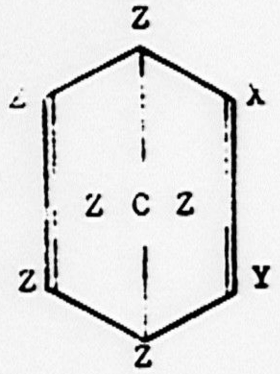
wherein each of the Z's is selected, independently of each other, from the group consisting of H, -R, and halogen atoms, R defining a saturated or unsaturated hydrocarbon radical or a substituted derivative of a saturated or unsaturated hydrocarbon radical, and wherein X and Y are independently selected from a group consisting of H, -Cl, -Br, -I, -R', -OR, -SR, $-N(R)_2$, $-N(R)_3^{+}$, $\underset{H_2}{C} - OH$, $\overset{H}{\underset{H}{C}} - SH$ and T, R having the value previously defined, R' being defined as a saturated or unsaturated hydrocarbon radical, and T being defined as the radicals represented by the formula



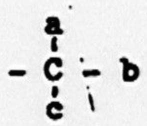
$$-\overset{a}{\underset{c}{C}}-b$$

in which a, b, and c represent attachments to all of the free bonds of the radicals selected from the group -H, -R, -Cl, -Br, -I, -OR, -SR, $-N(R)_2$, $-N(R)_3^{+}$, $-CH_2-(CH_2)_n-CH_2-$, =CH-CH=CH-CH=CH-, the unsaturated and substitution derivatives of $-CH_2-(CH_2)_n-CH_2-$ and the substitution derivatives of =CH-CH=CH-CH=CH-.

3. As new compositions of matter, compounds possessing the following structural formula:



wherein each of the Z's is selected, independently of each other, from the group consisting of -H, -R, -Cl and Br, R defining a saturated or unsaturated hydrocarbon radical or a substituted derivative of a saturated or unsaturated hydrocarbon radical, and wherein X and Y are independently selected from a group consisting of -H, -Cl, -Br, -I, -R', -OR, -SR, $-N(R)_2$, $-N(R)_3^+$, $-\underset{H_2}{C}-OH$, $\overset{H}{\underset{H}{C}}-SH$ and T, R having the value previously defined, R' being defined as a saturated or unsaturated hydrocarbon radical, and T being defined as the radicals represented by the formula



$$-\overset{a}{\underset{c}{C}}-b$$

in which a, b, and c represent attachments to all of the free bonds of the radicals selected from the group -H, -R, -Cl, -Br, -I, -OR, -SR, $-N(R)_2$, $-N(R)_3^+$, $-CH_2-(CH_2)_n-CH_2-$, $=CH-CH=CH-CH=CH-$, the unsaturated and substitution derivatives of $-CH_2-(CH_2)_n-CH_2-$ and the substitution derivatives of $=CH-CH=CH-CH=CH-$.

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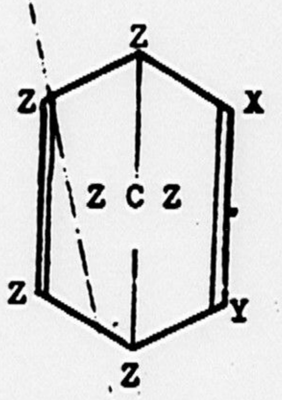
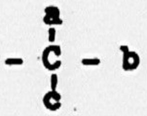
4. As new compositions of matter, compounds possessing the following structural formula:



wherein each of the Z's is selected, independently of each other, from the group consisting of -H and -R, R defining a saturated or unsaturated hydrocarbon radical or a substituted derivative of a saturated or unsaturated hydrocarbon radical, and wherein X and Y are independently selected from a group consisting of -H, -Cl, -Br, -I, -R', -OR, -SR, $-N(R)_2$, $-\overset{+}{N(R)_3}$, $-\underset{H_2}{C}-OH$, $\underset{H}{\overset{H}{C}}-SH$ and T, R having the value previously defined, R' being defined as a saturated or unsaturated hydrocarbon radical, and T being defined as the radicals represented by the formula

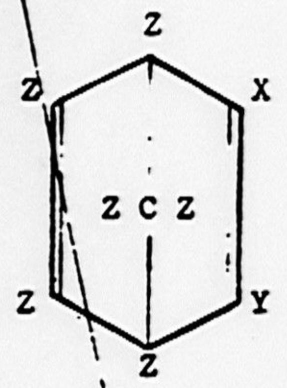


$$-\underset{c}{\overset{a}{C}}-b$$

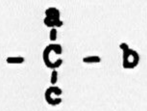
in which a, b, and c represent attachments to all of the free bonds of the radicals selected from the group -H, -R, -Cl, -Br, -I, -OR, -SR, $-N(R)_2$, $-N(R)_3^{+}$, $-CH_2-(CH_2)_n-CH_2-$, =CH-CH=CH-CH=CH-, the unsaturated and substitution derivatives of $-CH_2-(CH_2)_n-CH_2-$ and the substitution derivatives of =CH-CH=CH-CH=CH-.

18

5. As new compositions of matter, compounds possessing the following structural formula:



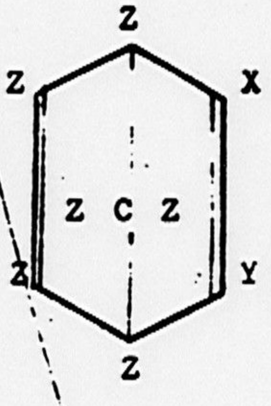
wherein each of the Z's is selected, independently of each other, from the group consisting of -Cl and -R, R defining a saturated or unsaturated hydrocarbon radical or a substituted derivative of a saturated a or unsaturated hydrocarbon radical, and wherein X and Y are independently selected from a group consisting of -H, -Cl, -Br, -I, -R', -OR, -SR, $-N(R)_2$, $-\overset{+}{N}(R)_3$, $-\underset{H_2}{C}-OH$, $\overset{H}{\underset{H}{C}}-SH$ and T, R having the value previously defined, R' being defined as a saturated or unsaturated hydrocarbon radical, and T being defined as the radicals represented by the formula



$$-\overset{a}{\underset{c}{C}}-b$$

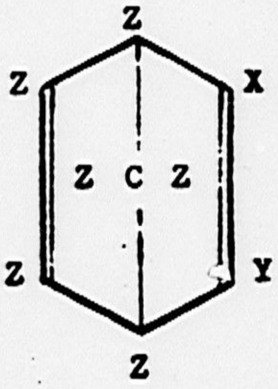
in which a, b, and c represent attachments to all of the free bonds of the radicals selected from the group -H, -R, -Cl, -Br, -I, -OR, -SR, $-N(R)_2$, $-\overset{+}{N}(R)_3$, $-CH_2-(CH_2)_n-CH_2-$, =CH-CH=CH-CH=CH-, the unsaturated and substitution derivatives of $-CH_2-(CH_2)_n-CH_2-$ and the substitution derivatives of =CH-CH=CH-CH=CH-.

6. As new compositions of matter, compounds possessing the following structural formula:



wherein each of the Z's is selected, independently of each other, from the group consisting of -H, -R, and halogen atoms, R defining a saturated or unsaturated hydrocarbon radical or a substituted derivative of a saturated or unsaturated hydrocarbon radical, and wherein X and Y is selected, independently of each other, from the group consisting of H, halogen atoms and hydrocarbon radicals.

7. As new compositions of matter, compounds possessing the following structural formula:

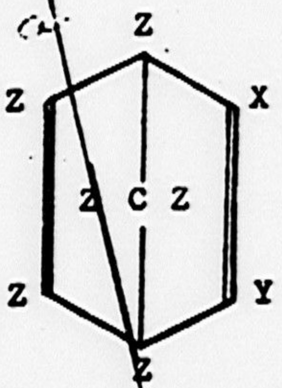


wherein each of the Z's is selected, independently of each other, from the group consisting of -H, -R, and halogen atoms, R defining a saturated or unsaturated hydrocarbon radical or a substituted

20 45573

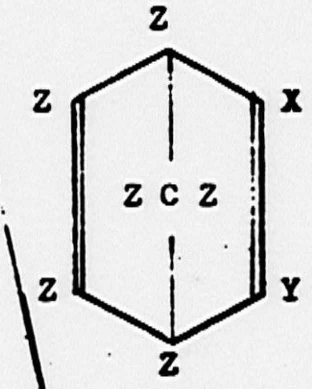
derivative of a saturated or unsaturated hydrocarbon radical, and wherein X and Y is selected, independently of each other, from the group consisting of -H and hydrocarbon radicals.

8. As new compositions of matter, compounds possessing the following structural formula:



wherein each of the Z's is selected, independently of each other, from the group consisting of -H, -R, and halogen atoms, R defining a saturated or unsaturated hydrocarbon radical or a substituted derivative of a saturated or unsaturated hydrocarbon radical, and wherein X and Y is selected, independently of each other, from the group consisting of halogen atoms and hydrocarbon radicals.

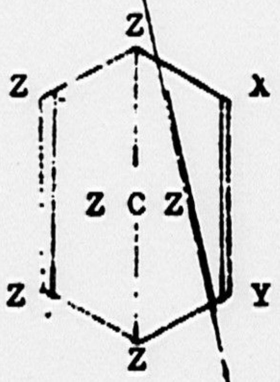
9. As new compositions of matter, compounds possessing the following structural formula:



a

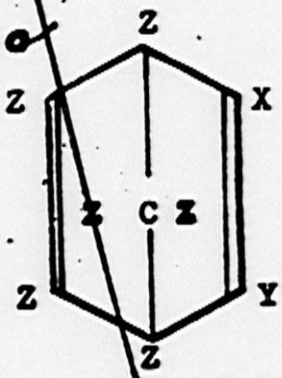
wherein each of the Z's is selected, independently of each other, from the group consisting of -H, -R, and halogen atoms, R defining a saturated or unsaturated hydrocarbon radical or a substituted derivative of a saturated or unsaturated hydrocarbon radical, and wherein X and Y is selected, independently of each other, from the group consisting of -H and halogen atoms.

10. As new compositions of matter, compounds possessing the following structural formula:



wherein each of the Z's is selected, independently of each other, from the group consisting of -H, and -R, R defining a saturated or unsaturated hydrocarbon radical or a substituted derivative of a saturated or unsaturated hydrocarbon radical, and wherein X and Y is selected, independently of each other, from the group consisting of H, halogen atoms and hydrocarbon radicals.

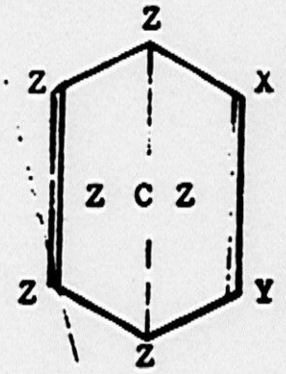
11. As new compositions of matter, compounds possessing the following structural formula:



wherein each of the Z's is selected, independently of each other, from the group consisting of -Cl and -R, R defining a saturated or unsaturated hydrocarbon radical or a substituted derivative of a saturated or unsaturated hydrocarbon radical, and wherein X and Y is selected, independently of each other, from the group consisting of H, halogen atoms and hydrocarbon radicals.

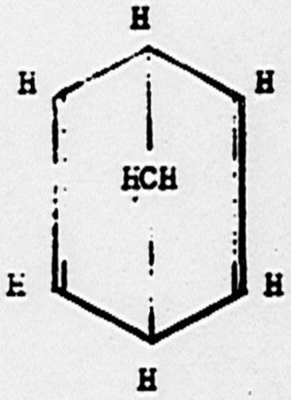
23 45571

12. As new compositions of matter, compounds possessing the following structural formula:

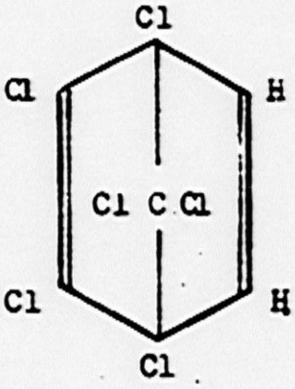


wherein each of the Z's is selected, independently of each other, from the group consisting of -H and -R, R defining a saturated or unsaturated hydrocarbon radical or a substituted derivative of a saturated or unsaturated hydrocarbon radical, and wherein X and Y is selected, independently of each other, from the group consisting of -H and hydrocarbon radicals.

13. As a new composition of matter, the hydrocarbon bicyclo-(2.2.1)-2,5-heptadiene possessing the structural formula



14. As a new composition of matter, the chlorinated hydrocarbon 1,2,3,4,7,7-hexachlorobicyclo-(2.2.1)-2,5-heptadiene possessing the structural formula



15. As a new composition of matter, the liquid hydrocarbon obtained by reacting together cyclopentadiene and acetylene at temperatures between 250° and 375° C and at pressures from 25 to 150 pounds per square inch gauge for periods of time from one minute to ten minutes duration which boils between 83.0 and 84° C at 620-635 mm mercury pressure, having a refractive index between 1.4685 and 1.4720 at 20° C and a density lying between 0.8770 and 0.9100 at 20° C.

16. The process of preparing the new composition of matter of claim ~~2~~ 26 which comprises reacting together a diene selected from the group consisting of cyclopentadiene and substituted cyclopentadiene with an acetylenic compound in the presence of ~~varying molar ratios~~ an excess of the acetylenic compound.

17. The process of preparing the new composition of matter of claim ~~2~~ 26 which comprises reacting together a diene selected from the group consisting of cyclopentadiene and substituted cyclopentadiene with an acetylenic compound in the presence of varying ~~molar ratios~~ an excess of the acetylenic compound and in the presence of a solvent.

18. The process of preparing the new composition of matter of claim ~~2~~ 26 which comprises reacting together a diene selected from the group consisting of cyclopentadiene and substituted cyclopentadiene with an acetylenic compound in the presence of ~~varying molar ratios~~ an excess of the acetylenic compound at temperatures ranging from 150-375° C and at pressures ranging from atmospheric to 250 pounds per square inch gauge.

19. The process of preparing B the new composition of matter of claim ~~2~~ 26 which comprises reacting together a diene selected from the group consisting of cyclopentadiene and substituted cyclopentadiene with an acetylenic compound in the presence of varying ~~molar ratios~~ an excess of the acetylenic compound and in the presence of a solvent at temperatures ranging from 150-375° C and at pressures ranging from atmospheric to 250 pounds per square inch gauge.

20. The continuous process for preparing the new composition of matter of claim 13 which comprises causing cyclopentadiene and acetylene to flow together through a heated reaction zone, and recovering D from the reaction product the Diels-Alder adduct formed by the reaction of one mole of cyclopentadiene with one mole of acetylene.

D
D
F

21. The continuous process for preparing a ~~the~~ new composition of matter ~~of claim 13~~ which comprises causing cyclopentadiene and acetylene in mole ratios between one to one and ~~to~~ one to ten to flow together through a reaction zone maintained at a temperature lying between 250 and 375° C and a pressure lying between 30 and 150 pounds per square inch gauge at such a rate as to cause the reactants to remain in the reaction zone for a period of time lying about between one and fourteen 14 ~~ten~~ minutes, both inclusive, and separating from the recovered reaction mixture the Diels-Alder adduct formed by the reaction of one mole of cyclopentadiene with one mole of acetylene.

E

2.6

I

[illegible] as 21

a)

22. The continuous process for preparing a new composition of matter which comprises causing cyclopentadiene and acetylene in mole ratios between one to one to one to ten to flow together through a reaction zone maintained at a temperature lying between 250 and 375° C and a pressure lying between 30 and 150 pounds per square inch gauge at such a rate as to cause the reactants to remain in the reaction zone for a period of time lying between one and ten minutes, both inclusive, and separating, by fractionation of the recovered reaction product, the liquid hydrocarbon material boiling between 83.0° and 84° C at 620-635 mm mercury pressure, having a refractive index lying between 1.4685 and 1.4720 at 20° C and a density lying between 0.8770 and 0.9100 at 20° C.

II

a)

23. The continuous process for preparing the new composition of matter of claim 13 which comprises causing cyclopentadiene and acetylene and a high boiling solvent material which will remain at least partly in liquid phase under the conditions prevailing in the reaction zone to flow together through a heated reaction zone, and recovering from the reaction product the Diels-Alder adduct formed by the reaction of one mole of cyclopentadiene with one mole of acetylene.

II a)

24. The continuous process for preparing the new composition of matter of claim 13 which comprises causing cyclopentadiene and acetylene in mole ratios between one to one ~~to~~ & one to ten and a high boiling solvent material which will remain at least partly in liquid phase under the conditions prevailing in the reaction zone to flow together through a reaction zone maintained at a temperature lying between 250 and 375° C and a

~~pressure lying between 30 and 150 pounds per square inch gauge at such a rate as to cause the reactants to remain in the reaction zone for a period of time lying between one and ten minutes, both inclusive, and D separating from the recovered reaction mixture the Diels-Alder adduct formed by the reaction of one mole of cyclopentadiene with one mole of acetylene.~~

F 25. The continuous process for preparing a new composition of matter which comprises causing cyclopentadiene and acetylene in mole ratios between one to one ~~to~~ and one to ten and a high boiling solvent material which will remain at least partly in liquid phase under the conditions prevailing in the reaction zone to flow together through a reaction zone maintained at a temperature lying between 250 and 375° C and a pressure lying between 30 and 150 pounds per square inch gauge at such a rate as to cause the reactants to remain in the reaction zone for a

E period of time lying between one and about fourteen ~~ten~~ minutes, both inclusive, and separating, by fractionation of the recovered reaction product the liquid hydrocarbon material boiling between 83.0 C and 84° C at 620-635 mm mercury pressure, having a refractive index lying between 1.4685 and 1.4720 at 20° C and a density lying between 0.8770 and 0.9100 at 20° C.

Add A
" B
" C
D

29 OATH, POWER OF ATTORNEY, AND PETITION

Being duly sworn that, we, Julius Hyman, and Ernest Freireich, and Rex E. Lidov, depose and say that we are citizens of the United States, residing, respectively, at Box 2171, Denver, in the County of Denver, and State of Colorado, and at 405 Josephine, Denver, in the County of Denver, and State of Colorado, and at 800 Adams Street, Denver, in the County of Denver, and State of Colorado; that we have read the foregoing specification and claims and we verily believe we are the original, first and joint inventors of the invention or discovery in

DIENIC HYDROCARBONS AND DERIVATIVES THEREOF

described and claimed therein; that we do not know and do not believe that this invention was ever known or used before our invention or discovery thereof, or patented or described in any printed publication in any country before our invention or discovery thereof, or more than one year prior to this application, or in public use or on sale in the United States for more than one year prior to this application; that this invention or discovery has not been patented in any country foreign to the United States on an application filed by use or our legal representatives or assigns more than twelve months before this application; and that no application for patent on this invention or discovery has been filed by us or our representatives or assigns in any country foreign to the United States.

And we hereby appoint WILKINSON, HUXLEY, BYRON AND HUME, a firm consisting of Charles L. Byron, James P. Hume, Howard Somervell, Gordon F. Hook, Howard W. Hodgkins, Ralph Munden, Milton T. Miller and Russel H. Clark, First National Bank Building, Chicago 3, Illinois, Registration No. 11,282, our attorneys or agents with full power of substitution and revocation, to prosecute this application and to transact all business in the Patent Office connected therewith.

Wherefore we pray that Letters Patent be granted to us for the invention or discovery described and claimed in the foregoing specification and claims, and we hereby subscribe our names to the foregoing specification and claims, oath and power of attorney, and this petition, this 23rd day of July, 1948.

Inventor........ Julius .... Hyman ....
First Name Middle Initial Last Name

Post Office Address: Box 2171
Denver, Colorado

Inventor............ Ernest .... Freireich ....
First Name Middle Initial Last Name

Post Office Address: 405 Josephine
Denver, Colorado

Inventor .... Rex .... E. .... Lidov ....
First Name Middle Initial Last Name

Post Office Address: 800 Adams Street
Denver, Colorado

STATE OF COLORADO)
) ss.
COUNTY OF DENVER)

Before me personally appeared Julis Hyman, to me known to be the person described in the above application for patent, who signed the foregoing instrument in my presence, and made oath before me to the allegations set forth therein as being under oath, on the day and year aforesaid.

(SEAL)

Dorothy R. Toothaker
Notary Public
My Commission Expires July 15, 1951

STATE OF COLORADO)
) ss.
COUNTY OF DENVER)

Before me personally appeared Ernest Freireich, to me known to be the person described in the above application for patent, who signed the foregoing instrument in my presence, and made oath before me to the allegations set forth therein as being under oath, on the day and year aforesaid.

(SEAL)
Dorothy R. Toothaker
Notary Public
My Commission Expires July 15, 1951

STATE OF COLORADO)
) ss.
COUNTY OF DENVER)

Before me personally appeared Rex E. Lidov, to me known to be the person described in the above application for patent, who signed the foregoing instrument in my presence, and made oath before me to the allegations set forth therein as being under oath, on the day and year aforesaid.

(SEAL)
Dorothy R. Toothaker
Notary Public
My Commission Expires July 15, 1951

Paper No. 2
31 Mailed April 5, 1949

* * * *

This application has been examined.
Reference made of record:

Alder et al 2,352,606 July 4, 1944 260-648x

Claims 1 to 12 and 16 to 19 are rejected as being fully met by Alder, above cited, who discloses preparing the

Diels-Alder adduct of cyclopentadiene with 2-methylbutin-3-ol-1.

In the absence of an allowable generic claim, election is required between the species of claims 13 and 14, respectively. The election of a product species will carry with it the corresponding process species.

Applicants are advised that their response to be complete under Order 3527 must include an election of species, or a statement that in their opinion all claims are in fact readable on a designated species, which applicants must identify, and that such statement will be construed as an election under the Order.

/s/ C. S. Duncomk
Examiner

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32 IN THE UNITED STATES PATENT OFFICE

Mailed Sept. 9, 1949

In re Application of)
JULIUS HYMAN et al.)
Serial No. 45,574) Division 31
Filed August 21, 1948)
For DIENIC HYDROCARBONS AND)
DERIVATIVES THEREOF)

AMENDMENT

Honorable Commissioner of Patents
Washington 25, D. C.

Sir:

In response to the Office action of April 5, 1949, kindly amend the above entitled application as follows:

In the claims:

Cancel claims 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 and 12

Claim 16, line 2, cancel "2" and insert—26—

Claim 16, line 5, cancel "varying molar ratios" and insert—an excess—

Claim 17, line 2, cancel "2" and insert—26—

Claim 17, line 5, cancel "varying molar ratios" and insert—an excess—

Claim 18, line 2, cancel "2" and insert—26—

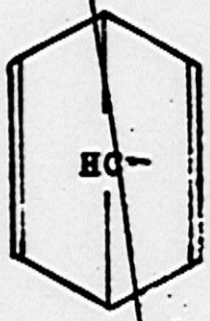
Claim 18, line 5, cancel "varying molar ratios " and insert—an excess—

Claim 19, line 2, cancel "2" and insert—26—

Claim 19, line 5, cancel "varying molar ratios" and insert—an excess—

Kindly add the following claims:

-- 26. As new compositions of matter, the compounds containing the basic carbon skeleton of bicyclo-(2.2.1)-2,5-heptadiene characterized by the presence of at least one hydrogen atom on the methano bridge represented by the planar structural formula



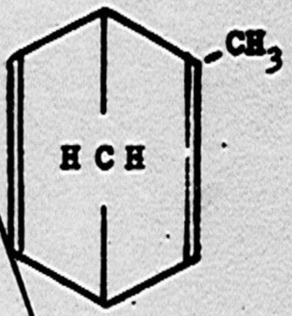
and further characterized by the absence of any elements other than carbon, hydrogen and halogen in the compounds.--

-- 27. Compounds according to claim 26 in which all of the elements carbon, hydrogen and halogen are present in the compounds. --

-- 28. Compounds according to claim 26 in which only carbon and hydrogen are present in the compounds. --

--29. Compounds according to claim 26 in which carbon is present only in the basic bicyclo-(2.2.1)-2,5-heptadiene basic carbon skeleton. --

~~-- 30. As a new composition of matter, the hydrocarbon bicyclo-(2.2.1)-2,5-heptadiene possessing the structural formula~~



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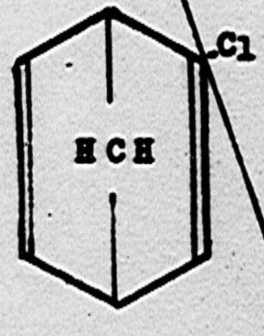
~~-- 31. As a new composition of matter, the hydrocarbon bicyclo-(2.2.1)-2,5-heptadiene possessing the structural formula~~



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REMARKS

Applicants have incorporated claims 26 to 29 as substitute claims for the previously presented Markush type of claims and have cancelled claims 1 to 12 in view of their rejection on the prior art. New claims 26 to 29 are much more limited in scope and are believed to overcome the rejection based on the Examiner's citations. They have been recast in order to avoid claims of the Markush type and moreover more fully to point out the actual characteristics and limits of applicants' invention. Limited generic claim 26 is believed adequately to cover applicants' contribution in the art, and the invention is more particularly defined in the sub-generic claims 27 to 29, in the retained claims 13 and 15 and the newly added claims 30 and 31.

It is thought that it will be apparent to the Examiner that all of these claims avoid the reference to Alder et al., and their allowance is courteously requested.

Reconsideration of claims 16 to 19, as amended, is courteously requested. It will be noted that the claims have been amended more particularly to point out applicants' improvement over the process vaguely suggested by Alder et al. in the cited reference.

Applicants have, in their response to the Office action, generally assumed that Example 16 of the Alder et al. patent properly discloses the reaction of cyclopentadiene with 2-methyl-butin-3-ol-1, although because of the complete absence from both the specification and the claims of any specific reference to reactions with such acetylenic compounds, there is reason to suspect that the
36 starting material actually employed may have been
2-methyl-buten-3-ol-1. This point of view is somewhat more strongly suggested by the fact that in Example 16 the cyclopentadiene is present in the ratio of two moles of the diene to one of the presumable acetyl-

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36 starting material actually employed may have been
2-methyl-buten-3-ol-1. This point of view is somewhat more strongly suggested by the fact that in Example 16 the cyclopentadiene is present in the ratio of two moles of the diene to one of the presumable acetyl-

enic compound. Now it is known that where the dienophile is activated, and Alder et al. is presumably teaching that the carbinol group activates the dienophile for the diene synthesis, the double bond which remains in the adduct between the carbon atoms previously joined by a triple bond is also activated and consequently tends to react further by a similar reaction to give the product of a two-to-one reaction of diene with dienophile. It is because of this tendency that applicants' find desirable and teach the use of an excess of the acetylenic dienophile, a teaching which cannot by any stretch of the imagination, be inferred from anything in the Alder et al. disclosure. Therefore, aside from the question which exists as to the actual relevancy of the patent cited because of the reasonable doubt as to the nature of the Alder et al. starting material in Example 16, it is evident that applicants' process claims are not anticipated by the teachings of the cited patent. It is, therefore, believed that amended claims 16 to 19 are in condition for allowance and this action is respectfully requested.

In the absence of an allowable generic claim, applicants elect to prosecute claims to the composition of matter as defined in claim 13. It is thought, however, that the new generic claim 26 is allowable, in which event applicants are entitled to claims to the species defined in claims 13, 30 and 31. Claim 14 is being held in abeyance pending the final disposition of this application.

Respectfully submitted,

WILKINSON, HUXLEY, BYRON & HUME
By Gordon F. Hook
Attorneys for Applicants

GFH/m

Chicago, Illinois
September 8, 1949

Paper No. 4

37 Mailed May 17, 1950

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Responsive to amendment filed September 9, 1949.

The following additional references are made of record:
Patterson et al "The Ring Index", page 110 (1940)
Norton "Chemical Reviews", Vol. 31, pages 387-92 (1942)

(Copies in Patent Office Scientic Library)

Claims 13, 15 to 26, 28 and 29 are rejected as being fully met by Patterson, above cited, who discloses bicyclo (2.2.1)-2,5-heptadiene (last three lines).

Claims 13, 15 to 26, 28 and 29 are rejected as lacking invention over Alder, of record, or Norton above cited, who discloses the reaction of various acetylenic compounds with cyclopentadiene. No invention is involved in using acetylene itself or in the determination of the optimum conditions for the reaction.

Claims 26, 28 and 29 are rejected as being broader than is warranted by the disclosure and as improperly defining the invention in the inclusion of negative limitations and in the failure to completely define the claimed compounds.

Claims 14, 27, 30 and 31 are rejected as not being readable on the elected species.

This application should be prepared for final action.

/s/ A. M. Boettcher
Actg. Examiner

144 A

MAIL DIVISION
NOV 14 1950
U.S. PATENT OFFICE

Amdt. +
Paper No. 53
NOV 15 1950
DIVISION 31

(Case No. 48,224)

IN THE UNITED STATES PATENT OFFICE

In re Application of
JULIUS HYMAN et al
Serial No. 45,574
Filed August 21, 1948
For DIENIC HYDROCARBONS AND DERIVATIVES THEREOF

Division 31

AMENDMENT

Honorable Commissioner of Patents
Washington, D. C.

Sir:

In response to the Office Action of May 17, 1950, applicants amend as follows:

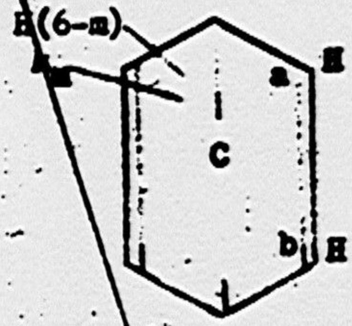
In the claims:

Cancel claims 14 to 19 and 26 to 29

Add the following claims:

32. As a new composition of matter, the compounds having the planar structural formula

B'



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wherein R is an aliphatic hydrocarbon radical and wherein m assumes an integral value between zero and six, both inclusive, and its derivatives in which monovalent substituents are independently substituted into positions a and b, said monovalent substituents being characterized in that the elements

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B' cont'd

contained therein are limited to hydrogen, halogen, oxygen and carbon and the composition being further characterized in that it is free of stabilizing components attached to carbon atoms in exocyclic positions alpha to the double bonds, such stabilizing components being defined as halogen atoms, oxygen atoms, sulphur atoms, nitrogen atoms and aryl radicals.

?

33. Compounds according to claim 32 in which the elements contained in the monovalent substituents are limited to hydrogen, halogen and carbon.

D

34. Compounds according to claim 32 in which the elements contained in the monovalent substituents are limited to hydrogen and halogen.

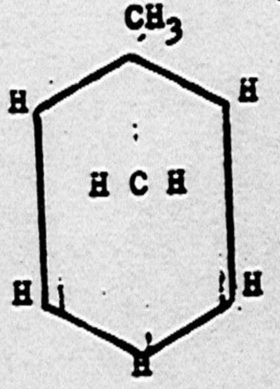
A

35. Compounds according to claim 32 in which the elements contained in the monovalent substituents are limited to hydrogen and carbon.

M.G.

36. Compounds according to claim 32 in which the elements contained in the monovalent substituents are limited to halogen.

37. As a new composition of matter, the hydrocarbon 1-methyl bicyclo-(2.2.1)-2,5 heptadiene possessing the structural formula



M.Y.

2 39

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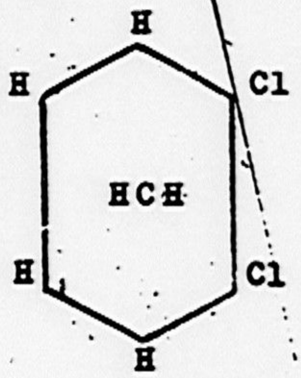
B' Cnt'd

38. As a new composition of matter, the compound 2,3-dichloro bicyclo-(2.2.1)-2,5 heptadiene possessing the structural formula

M.C



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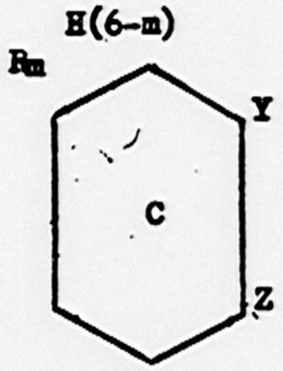
39. A new composition of matter having the planar structure

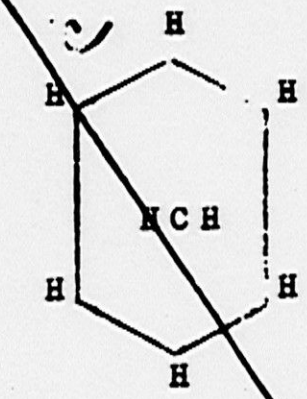


wherein R is an aliphatic hydrocarbon radical, wherein m assumes an integral value between zero and six, both inclusive, and wherein Y and Z are independently selected from the group consisting of hydrogen atoms, halogen atoms, hydrocarbon radicals, halogenated hydrocarbon radicals and oxygenated hydrocarbon radicals, Y and Z being free of stabilizing compenents on exocyclic carbon atoms directly attached to the ring carbon atoms bearing an endocyclic double bond, such stabilizing components being defined as halogen atoms, oxygen atoms, sulphur atoms, nitrogen atoms and aryl radicals.

40 [illegible]

B' Cont'd

~~40. As a new composition of matter having the planar structure~~



~~the liquid hydrocarbon which is the reaction product formed by the Diels-Alder addition of cyclopentadiene and acetylene.~~

~~41. As a new composition of matter, the liquid hydrocarbon which boils between 83.0° and 84° C at 620-635 mm mercury pressure, having a refractive index between 1.4685 and 1.4720 at 20° C and a density lying between 0.8770 and 0.9100 at 20° C which is the reaction product formed by the Diels-Alder addition of one mol of cyclopentadiene to one mol of acetylene at temperatures between 250° and 375° C and at pressures from 25 to 150 pounds per square inch gauge for periods of time from one minute to ten minutes duration.~~

D

42. The process of preparing the new composition of claim 32 which comprises reacting together a diene selected from the group consisting of cyclopentadiene and cyclopentadienes containing aliphatic hydrocarbon substituents with an acetylenic compound free of components attached to a carbon

41 #357

B' Cont'd

atom alpha to the reacting acetylenic bond capable of stabilizing any Diels-Alder reaction product obtained in the reaction, such stabilizing components being defined as halogen atoms, oxygen atoms, sulphur atoms, nitrogen atoms and aryl radicals, in the presence of an excess of the acetylenic compound.

43. The process of claim 42 in which the reaction is conducted at temperatures ranging from 150-375° C and at pressures ranging from atmospheric to 250 pounds per square inch gauge.

44. The process of claim 42 in which the reaction is conducted in the presence of a solvent.

45. The process of claim 44 in which the reaction is conducted at temperatures ranging from 150-375° C and at pressures ranging from atmospheric to 250 pounds per square inch gauge.

REMARKS

The oral conference courteously granted by the Examiner is hereby acknowledged.

During the oral conference the merits of this application were discussed in detail with the Examiner and certain claims were presented for his consideration in substitution of certain of the claims now appearing in this application. These claims were discussed as to form and merit and the substance of the invention was presented by one of the joint inventors. As a result of this conference, certain of the claims of this application have been cancelled and

42

43 claims along the line of claims discussed during the conference substituted therefor. Claim 39 constituting the basic claim reviewed by the Examiner is of the Markush type and is generic to the disclosure of this application. While it is recognized that the Examiner indicated a preference for this type claim, nevertheless, Claims 32 to 36 have been presented herein; these claims are of a true generic form which applicants believe desirable for the purpose of meeting any contingency that may arise at a later date in the event of litigation. The Examiner will appreciate the limitations imposed on claiming in Markush form make it difficult to provide that degree of protection which is desirable when patents become involved in litigation. It is believed that the Examiner will clearly recognize that Claims 32 and 39 are of similar scope; while the recent amendment to the Rules of Practice permit both types of claims in an application, it should be noted that where a claim can be drawn in true generic form such a form is deemed preferable.

Claim 41 has been incorporated to take the place of cancelled claim 15, and Claims 37 and 38 have been added as specific claims to compositions contemplated by the disclosure which, together with Claims 13, 30 and 31 are the five species which, under the rules, are permitted to be included under a generic claim.

Claims 42 to 45 have been substituted in lieu of Claims 16 to 19 and are limited so that the process claims will conform to the scope of the generic composition claims 32 and 39.

Claim 40 is on the order of claims presented to the Examiner in discussing a co-pending application.
44 The Examiner indicated that while the claim on its face might appear to be a product-on-process type of claim, nevertheless, the same is so drawn as to

avoid the usual objections raised by the rules of the Patent Office with respect to the inclusion of that type of claim together with composition claims in the same application.

Claims 13, 15 to 26, 28 and 29 have been rejected as fully met by Patterson cited, who discloses bicyclo-(2.2.1)-2,5-heptadiene. Some of these claims have now been cancelled and claims 32 to 45 have been added; claims 17 to 25, however, have been retained. In the first place, it should be noted that claims 17 to 25 are process claims and, without discussing the validity of the rejection on Patterson, it must be obvious that the process claims under any circumstances are not properly rejectable on the basis of this reference. It is therefore respectfully requested that the rejection of these claims on the basis indicated be removed; the Examiner will recall that as a result of the recent interview it was agreed that this should properly be done.

Applicants question whether under any circumstances that Patterson is a proper reference. It should be noted that, in fact, Patterson is at best a compilation of ring systems. The presence of particular ring systems in that reference does not imply, and is not intended to imply, either that the apparent ring shown does, *per se* exist, or can *per se* exist. Patterson is concerned with a particular aspect of organic chemistry, namely, the nature of the rings which may be present in organic molecules; as a result, in a sense, Patterson's view of organic molecules as presented in the Ring Index is somewhat distorted. Patterson concerns himself only with the rings contained in organic molecules, eliminating, for his purposes, any other parts of the compound which may actually be present. Hence, when Patterson discusses the adduct of cyclopentadiene with acetylene dicarboxylic acid which, in fact, gives rise to a dicarboxy bicycloheptadiene he writes of the substances as though it were simply a bicycloheptadiene; the peculiar type of abstracting of organic chemistry which results cannot properly be called a disclosure of bicycloheptadiene itself. Applicants suggest that it is highly improper so completely to remove material from its actual context as is required to utilize the Patterson text as a reference against applicants' claims since the actual material of that text shows that insofar as Patterson is concerned he had reference not to bicycloheptadiene but to certain of its derivatives not comprehended by the scope of applicants' claims.

It is particularly noteworthy that Patterson, who in his compilation of the Ring Index gives references which will show where, in the literature, material with respect to the rings he discusses can be found, does not show any reference to bicycloheptadiene itself or to its simple unstabilized derivatives. As previously noted, the actual and only reference given is to a dicarboxy derivative of the parent molecule, said parent molecule having been prepared for the first time by applicants. In order to facilitate examination of the actual reference, there is attached to this amendment a translation of the actual citation in Patterson. This translation has been 46 prepared by a qualified scientific translator who regularly does translation work for chemical abstracts and a variety of scientific translation organizations.

At the previously referred to interview, the Examiner referred to certain decisions which, in the Examiner's opinion, appear to support the rejection on the basis of the Patterson reference.

The cases cited are ex parte Sloan 73 USPQ 266, Eastman Kodak Company v. Coe 51 USPQ 407, in re Crosley et al 600 O.G. 172, in re Stoll et al 603 O.G. 378 and in re Von Bramer et al 542 O.G. 183. None of these decisions appears to be pertinent from the standpoint of supporting the Examiner's position with respect to the rejection of the claims on the Patterson reference.

In the case of Eastman Kodak Company v. Coe, the applicant Bean was attempting to secure claims to compounds for stabilizing gasoline against gum formation, one of such compounds consisting of N-(n-primarybutyl)-p-aminophenol.

The references relied upon by the Examiner in that case all disclosed stabilizing compounds for gasoline including one or more of the compounds claimed by applicant and described the properties of such compounds and their particular adaptability as stabilizing agents for gasoline. Applicant, in traversing the Examiner's rejection in that case urged that such patents cited were not valid references for the reason that they contained no disclosure of a process for making such compounds. The Court, in deciding the case adversely to the applicant, pointed out that there was a complete disclosure of the claimed subject matter and recognition of the chemical properties of the compounds sufficient to
47 constitute an anticipation, regardless of the fact that there was no actual disclosure of a process for forming such compounds.

These references, on the basis of which Bean in the Eastman case was denied claims, did in fact do more than simply name the compounds which he was attempting to claim, because by setting forth their usefulness in the manner that these references did, they made it clear that

(a) a skilled practitioner in the art could expect that Bean's compound might be brought into existence;
(b) they indicated clearly that once it was brought into existence, its properties might be anticipated; and

(c) they indicated clearly that the actual compound named was the one with which he was concerned.

All of these facts are implicit in the Court's decision.

The present case is entirely different with respect to these basic aspects.

The Patterson reference does not in fact deal with the actual parent hydrocarbon. All Patterson says is that a particular compound—in this case the dicarboxy bicycloheptadiene—may be considered a derivative of the unknown bicycloheptadiene. This represents only a formal relationship. Patterson neither says, nor implies, that bicycloheptadiene does exist, nor that it can exist. It is perfectly obvious, of course, that there is no recognition of any of the properties which the then non-existent bicycloheptadiene might possess, and finally it is clear that the actual compound to which Patterson has reference is not bicycloheptadiene.

48 The case of In re Von Bramer et al has to do with an appeal of rejected claims directed to subject matter similar to that of the Eastman Kodak Company v. Coe case. The fact situation is on all fours with the fact situation of the latter case, and the above remarks directed to the non-pertinency of that decision appear to apply in all respects to the decision in this case. Of interest, however, are certain comments made by the Examiner in rejecting the claims and quoted in full by the Court in its decision sustaining the Examiner's rejection. Such comments as are of interest herein are as follows:

> "* * * a chemically individual substance of definite chemical molecular structure is defined having generally predictable properties such as found for any similar N-alkyl amino phenol, and generally capable of synthesis by the recognized classical organic reactions."

It is clear that this particular set of facts involves the belief that the compound concerned is only a species of a well defined class, that it may be prepared by classical methods well known to the art, and that its properties are easily predictable on the basis of other similar compounds, is again basic to the decision of the United States Court of Customs and Patent Appeals.

Aside from what has been previously said about the error of assuming a similarity between the Patterson citation and cases of this type, these additional factors can now be specifically noted. Cyclopentadiene *per se* is not readily preparable by any classical means, (and
49 as has already been noted Patterson does not
suggest that it can be prepared), and its properties are not predictable. As a matter of fact, applicants have found its behavior basically at variance with that which might be expected simply on the basis of its formal structure.

It seems clearly apparent that this decision, relied upon by the Examiner, is not in point from the standpoint of supporting the rejection of the claims on the reference to Patterson.

In the case of in re Stoll et al, the claims on appeal were directed to new compositions, including hydrogenated ergotoxine and ergotamine. The main reference to Kharasch relied upon by the Examiner in that case in his rejection stated that hydrogenated ergotoxine and ergotamine had been prepared by the same process disclosed in the specification, but such particular compounds were not claimed in the application. The Court in its decision clearly indicated that the reference went much further than to merely name the stated compounds. In fact, it was the opinion of the Court that the assertion by Kharasch that he had prepared the compound in question was probably correct; and further it was the opinion of the Court that even had the compound in question not actually been prepared, it was obvious from Kharasch's disclosure exactly how it might be prepared.

Obviously, the situation involving Patterson as a reference against the claims in this application is not at all comparable to the fact situation as it existed in in re Stoll et al, as the Examiner will undoubtedly appreciate by further review of that decision.

50 In the case of *in re Crosley et al,* the claim on appeal involved purified sodium tetrathinoate as a new composition having certain therapeutic properties. It is clear from the decision that sodium tetrathionate in unrefined form was known prior to applicants' disclosure and as a matter of fact was recognized as having the same therapeutic value.

Without further discussing the details of that case, it seems clear that the same is not at all pertinent in supporting the Examiner's position with respect to the rejection of the present claims on Patterson.

It seems pointless to further burden this phase of the discussion by detailed examination of ex parte Sloan, since here again the apparent prior disclosure of a compound by name alone turns out rather to be a much more complete disclosure, indicating that the compound will have the properties claimed for it by the applicant, against which the references were cited, and indicating further that the compound can be prepared by methods well known to the art. Consequently, for the reasons already given, the use of this reference to support the rejection of applicants' present claims on Patterson is believed improper.

However, this case of ex parte Sloan must be considered briefly from another standpoint. It should be noted that the doctrine therein contained indicates explicitly that a previous disclosure under the circumstances outlined can be effective only in rejecting a claim to the actual compound named by that previous disclosure.

It follows, therefore, that even if Patterson were a

reference against bicycloheptadiene *per se* (and
51 it should be clear by now that it is not), Patterson cannot be used as a reference for the rejection of applicants' claims to other unstabilized derivatives of bicycloheptadiene.

Reconsideration of the rejection of applicants' claims on Patterson for all of the reasons given is respectfully requested.

The Examiner also rejects the claims "as lacking invention over Alder of record, or Norton, above cited, which discloses the reaction of various acetylenic compounds with cyclopentadiene." The Examiner also states "that no invention is involved in using acetylene itself or in the determination of the optimum conditions for the reaction." Suffice it to say for the moment that the Norton publication shows no compounds other than those whose previous existence is clearly set forth in the specification of the present application. These compounds are not claimed, and as the specification points out, their existence does not suggest that the compounds which applicants do claim are capable of existence, or can be prepared. This particular aspect of the situation will be discussed more fully later on.

As has previously been noted in the last amendment, the showing in the Alder patent of a reaction between cyclopentadiene and acetylenic alcohol is believed to be the result of some sort of error. This previous suggestion is now confirmed by the fact that diligent search of the chemical literature has failed to disclose the existence of the acetylenic compound which, according to Alder, he had reacted with cyclopentadiene. A highly qualified chemical literature researcher, a man authorized to make translations from the Russian for Chemical Abstracts, who is further capable, and as a matter in his
52 regular work normally does translate chemical scientific literature from approximately twenty lan-

guages into English, has been unable to find any reference to Alder's presumable starting material in the chemical literature. If the Examiner so desires, affidavits will be supplied setting forth both the qualifications of the library research man responsible for this investigation and showing the extent to which the literature has been examined.

It would seem obvious, therefore, that the apparent anticipation by Alder of applicants' subject matter is the result of some sort of error. While the nature of the error is not known, it is suggested, in consideration of the remainder of the Alder examples, that a misprint has appeared which has resulted in the substitution of an "i" for an "e", and that the actual intention of Example 16 is to call for the reaction of 2-methyl-buten-3-ol-1 instead of 2-methyl-butin-3-ol-1.

Nonetheless, many of the claims previously in the case have been cancelled and new claims have been added in order more specifically to bring the claims into accord with applicants' teachings, as set forth in the specification. The Examiner will note that the specification indicates that the major teachings of the present applicants resides in their discovery of the fact that bicycloheptadienes which are unstabilized by additional groups on that ring system can be prepared. Applicants pointed out specifically that stabilization is effected by the carboxy group, by carboxy-ester groups, and by carbonyl groups when such groups are attached to the carbons bearing the cyclic double bonds.

53 It should be noted, incidentally, that this type of stabilization is caused by oxygen atoms present on the exocyclic carbon atom or atoms, alpha to an endocyclic double bond in those molecules, and it follows as a logical consequence that other groups and atoms similarly attached may also be capable of effecting such stabilization.

It would seem unnecessary at this point to burden this amendment with lengthy discussion of the reasons for such stabilization, and it will probably suffice to call the Examiner's attention to the discussion of this subject at the interview so courteously afforded applicants' attorney, during which it was pointed out that this stabilization results from resonance phenomena which, in effect, diminish the double bond character of the endocyclic double bond.

The Examiner will also recall that the bicycloheptadiene ring containing two double bonds having complete double bond characteristics can be shown by calculation to be very highly strained, and he will recall that there are no instances in the prior art in which such strained bicyclopentadienes, unstabilized in the fashion previously discussed, have ever been prepared.

As has previously been noted herein, it may logically be expected that stabilization of such rings might be effected by groups other than the carboxy group or the carboxy-ester group.

In general, the groupings which, it might be anticipated, would effect such stabilization are polar radicals of the type set forth in lines 37 to 41 of column 1, page 1, of the Alder patent cited. A careful examination
54 of the atoms and radicals therein set forth
will show that they can exert their effectiveness in stabilizing bicycloheptadienes when the elements oxygen, sulphur and nitrogen, and when the aryl radical, either singly or in combination, are present on a carbon atom alpha to the endocyclic double bond.

While applicants are not aware that any bicycloheptadiene containing such elements in that position have ever been prepared except for those specifically cited in the specification of the present application, it is clearly within the limitations of applicants' teaching that such stabilized compounds might, as a result of the teachings of the prior art, be expected to be preparable, and applicants believe that their claims should therefore be unambiguously restricted to bicycloheptadiene and its derivatives, in which such stabilization is not present.

Accordingly, the new claims which have been added are so drawn as to make this limitation unambiguous. The rejection of applicants' claims on the basis of either Norton or Alder would appear completely improper, and reconsideration of this rejection and allowance of the claims are therefore respectfully requested.

As has already been set forth, the formation of bicycloheptadiene itself is completely new and unexpected, and since this is the case, the Examiner's statement that no invention is involved in using acetylenic compounds would appear to be without substantiation.

Aside from this, however, it must be pointed out that no method previously disclosed for the preparation of adducts of cyclopentadiene with acetylenic dienophiles would permit, or could be adapted to permit, the preparation of the adduct of cyclopentadiene and acetylene.

55 The procedure that has been used for the preparation of various carboxy and ketone derivatives of bicycloheptadiene all involve the simple bringing together of the reactants; in some cases the reaction then proceeds without the application of heat; in other cases mild heating is required; and in some instances it may or may not be desirable to conduct the heating in a sealed vessel.

Even assuming for the moment that the procedure of Example 16 of the Alder patent actually teaches something about the preparation of a cyclopentadiene adduction with an acetylene (for the reasons already given this would clearly seem not to be the case), it must be noted that there too all that is taught is that a substituted acetylene and cyclopentadiene are brought together in some desired molar ratio and heated under pressure to bring about the reaction wanted.

None of these methods is applicable if it is desired to bring about a reaction of cyclopentadiene with acetylene itself, and, as a matter of fact, any attempt to carry out that specific reaction by any obvious or simple adaptation of these methods would in the best case lead to simple failure, and in the worst give rise to dangerous explosions.

In order to cause the reaction of acetylene with cyclopentadiene, widely different procedures had to be invented, and it was necessary to discover the highly critical conditions under which the reaction could be successfully accomplished.

The Examiner's contention, therefore, that no invention is involved in using acetylene itself or in the determination of the optimum reaction is wholly without merit and should be withdrawn.

56 The Examiner's attention is also respectfully drawn to the fact that at the previously mentioned interview he agreed that there was in fact invention in the process for carrying out these reactions, and that process claims essentially similar to those previously presented would be allowed provided they were so drawn as more specifically to limit them to the actual new products claimed in the composition matter claims. This has been done, and it is believed that on the basis of the discussions had in that interview the process claims as they now appear are in condition for allowance, and this action is respectfully requested.

The claims now incorporated in this application as a result of the conference are believed to be in proper formal condition for allowance, and previous rejections by the Examiner as to the claimed structure would not appear to apply to these newly presented claims.

In view of the above, it is submitted that the claims in this application are in condition for allowance and a favorable action to that end is respectfully solicited.

Respectfully submitted,

Wilkinson, Huxley, Byron & Hume

By Gordon F. Hook

Chicago, Illinois
November 13, 1950

65 Paper No. 6. Mailed July 17, 1951

* * * *

Responsive to amendment filed November 14, 1950.

Claims 13, 32 to 35, 39, 40 and 41 are rejected as being fully met by Patterson, of record. It is still considered that the mere disclosure of a formula serves to anticipate a claim thereto.

Claims 13, 33, 34, 35, 40, 41, and 45 are rejected as lacking invention over Alder et al or Norton, of record. No invention is involved in trying acetylene as the reagent, where acetylenic compounds, broadly, are suggested in the prior art. The use of a solvent in the process is disclosed by Alder et al.

Claims 32, 39, 42, 44, 46 and 47 are rejected as being fully met by Example 16 of Alder et al and as lacking invention over Norton for the reason indicated in the preceding paragraph. Applicants' inability to find Alder's starting material in the literature cannot be given any weight in view of the clear teaching of the Example.

Claims 32 to 35, 39 and 42 to 45 are rejected as not being adequately supported by the disclosure and as improperly defining the invention. The only acetylenic compound disclosed in the examples is acetylene itself. This does not warrant the broad and speculative genera claimed, the exact scope of which is difficult, if not impossible to determine.

66 Claim 32 is further rejected as being alternative in claiming a compound and its derivatives. Markush terminology must be employed in such situations.

All the claims are rejected on the ground of undue multiplicity. Considerable duplication in claiming exists. For example, claims 40 and 41 are of the same scope as claim 13; claims 22 and 25 are of the same scope as claims 21 and 24 respectively; and claims 33, 34 and 35 involve considerable overlapping.

Claims 30, 31, 36, 37 and 38 are rejected as not being readable on the elected species.

In the absence of an allowable generic claim, further election is required between the species represented by claims 21 and 24, respectively.

Applicants are advised that their response to be complete under Rules 143 and 111 must include, in addition to a response to the rejection, an identification of the disclosed species that they elect consonant with the requirement, and a listing of all claims restricted or generic thereto. An argument that the generic claims are allowable, or that all claims are generic or amended to be generic, unless accompanied by an election, is nonresponsive.

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IN THE UNITED STATES PATENT OFFICE

Paper No.
JAN 15 1952
DIVISION 31

Julius Hyman et al.)
Serial No. 45,574) Division 31
Filed August 21, 1948)
For DIENIC HYDROCARBONS AND DERIVATIVES THEREOF) **AMENDMENT**

Hon. Commissioner of Patents
Washington 25, D. C.

Sir:

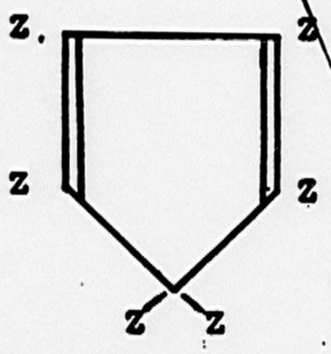
In response to the Official Action of July 17, 1951, the above identified application is hereby amended as follows:

Cancel claim 40.

Insert the following claims:

---

46. A process of forming bicyclo (2.2.1) 2-5-heptadiene and unstabilized derivatives thereof, which comprises reacting at a temperature between 150° C and 375° C and a pressure of atmospheric to 250 pounds per square inch gage, a cyclic conjugated dienic compound having the formula:



with an acetylenic compound in excess of a 1:1 molar ratio and having the formula:

$$Y.\,C\equiv C.\,Y$$

69

45

~~wherein each Z is independently selected from the group consisting of hydrogen and unsubstituted aliphatic hydrocarbon radicals; wherein each Y is independently selected from the group consisting of hydrogen, halogen, unsubstituted hydrocarbon radicals, halogenated hydrocarbon radicals substituted elsewhere than on a carbon atom alpha to the unsaturated bond, and oxygenated hydrocarbon radicals substituted elsewhere than on a carbon atom alpha to the unsaturated bond; wherein each Z is hydrogen whenever any Y is other than hydrogen; and wherein each Y is hydrogen whenever any Z is other than hydrogen.~~

~~47. A compound produced by the process of claim 46, and consisting of the 1:1 adduct of said conjugated diene and said acetylenic compound.~~

REMARKS

The rejection of claims 13, 32-35, 39 and 41 as being fully met by Patterson is again traversed. As has been pointed out previously, the Patterson ring index is primarily a compilation of basic ring structures, with reference to derivatives which are known. In connection with bicycloheptadiene, the reference in Patterson is not to the parent compound itself, but to a dicarboxylic derivative. Obviously, Patterson clearly refutes any suggestion that bicycloheptadiene had ever existed, and merely states what would be its name if someone ever succeeded in producing it. Applicants recognize that the decisions, upon which the Examiner relies, have tended more and more to give lip service to a doctrine which apparently originated in Cohn v. United States Corset Company 93 U.S. 366, decided in October 1876. That case was decided upon a British specification which was

71 found to describe with sufficient certainty and clearness a corset having the improvement claimed by the plaintiff. A detailed discussion of the highly illogical decision reached by the Patent Office, in the interpretation of in re Von Bramer, and other cases relied on by the Examiner is contained in an illuminating article by Maurice W. Levy at page 401 of the June 1951 issue of the Journal of the Patent Office Society.

The present rejection on Patterson illustrates clearly and succinctly the blind application of a doctrine until an end result, clearly reductio ad absurdum, is reached. This result, mystifying to many chemists and considered as utterly stupid by others, is apparently the result of the Patent Office either overlooking or deliberately paying no attention to the fact that a claim to a chemical compound, by means of the formula, is not an attempt to copyright the formula, but is a claim to the compound which trained chemists will recognize as represented by the formula. This representation of compounds by formula has resulted not only in ludicrous decisions, but also amusing incidents. For instance, recently in connection with a law suit invoving a chemical compound indentified by its formula, the Judge asked: "Can you actually see these carbon and hydrogen atoms?" The logical answer to his question would, of course, have been: "No your Honor, but a Patent Office Examiner thinks he can."

Recognizing that what applicants are claiming is the compound—the actual physical compound—and that a claim to the compound, even though it were claimed by the formula, could not possibly be infringed by someone writing the formula, either structurally or in
accordance with the Geneva Convention, it is
72 clearly evident that the doctrine "that which in-
fringes, if earlier would anticipate," is clearly not

satisfied. One could do everything described by Patterson, and all the articles and publications to which Patterson refers, without coming close to infringing any claim of the present application. Furthermore, when tested by the provisions of 35 U. S. Code 31, it is quite clear that Patterson does not anticipate applicants' claimed method and compounds. Obviously, Patterson did not know nor did Patterson use the compound bicycloheptadiene, nor did Patterson patent this compound. The only question then is whether or not Patterson described the compound. It is believed clearly evident that a mere structural formula is not a description of the compound, unless supported by the physical and chemical characteristics by which the compound can be identified as having such a structure, or some way in which the compound can be prepared. Applicants' claims which refer to the compound or compounds being claimed by structural formula are, of course, clearly supported by the physical and chemical characteristics set forth in applicant's specification, and further by the process disclosed in applicant's specification. Actually, of course, a structural formula of a chemical name means nothing unless the evidence upon which the theory that a specific compound has such a structure are present. Further, a claim to a compound or compounds by structural formula, really means that compound or those compounds which have physical and chemical characteristics which lead chemists to believe that it has such a structure.

The manner in which a decision relating to a corset has been twisted around to reach the present absurd result is, of course, apparent. A corset, of course, can
73 be seen in a drawing or a written statement describing the physical parts and these physical parts can be reproduced so that they can be seen by the human eye, and be felt by the human hand. Obviously, the atoms in a molecule of a chemical compound can be neither seen

by the human eye, nor felt by the human hand. The only thing that can be done is to ascertain the physical and chemical characteristics of the compound, i.e. its reaction with various reagents, its molecular weight, its boiling point, its specific gravity and other characteristics. Of course, the human eye can ascertain whether it is a solid, gas or liquid at certain temperatures, and if a solid or liquid, whether it is colored or colorless, and also how it feels to the hand and how it smells to the nose. Nevertheless, these are characteristics of the compound itself, and not of the structural formula. In other words, the structural formula of Patterson would be red if printed in red ink, would be green if printed in green ink, would be purple if printed in purple ink, but the color of the printing of the structural formula obviously tells nothing of the state or color of the compound itself.

Applicant therefore submits that a mere chemical formula does not describe the compound, but merely indicates what a chemist would believe the structure of the compound to be, based upon generally accepted theories of structure, if there were sufficient evidence to indicate that the generally accepted tests of the various theories were met.

Patterson is thus no more pertinent than Alder or Norton, and it is noted that the Examiner has not rejected any of applicants' claims as being fully met by Norton, but only as lacking invention thereover.

74 It is further noted that in the J.P.O.S. article previously referred to, the author castigates the habit of the reliance of the Patent Office on a typographical error, and that is exactly what the Examiner is doing in the Alder patent. The example relied on by the Examiner is Example 16, which as printed by the U. S. Patent Office reads "2-methyl-butin-3-ol-1". However, Example 16 of German Patent No. 725,082—on which Alder U. S. 2,252,606 is based, under the International Con-

vention—reads "2-methyl-butin-3-o1-2". Also under Example 16, in the German patent, Alder shows a structural formula which is conclusive that the hydroxyl group is alpha to the triple bond in the acetylenic compound, and not beta to the triple bond, as the typographical error in the U. S. patent would apparently indicate. This disparity between the German patent and the U. S. patent based thereon is corroborated by the applicant's failure to find any mention in chemical literature of the existence of or any knowledge of the compound alleged to be disclosed in Example 16 of the Alder U. S. patent.

It is thus evident that not only is the Examiner relying upon the mere writing of a formula, in Patterson, but also upon an obvious typographical error, in Alder, and that these two unwarranted and unreasonable actions are the two types of actions which are shown to be so in the discussion in the J.P.O.S. article previously referred to.

The Alder patent is, of course, clear and cogent evidence that applicants have made an invention. It is quite obvious from the discussion by Alder that this renowned
expert in the art, one of the persons for whom the
75 Diels-Alder reaction is named, believed that a
Diels-Alder reaction between cyclopentadiene and
an acetylenic compound could not be carried out unless the acetylenic compound carried a "polar radical" in alpha position to the double or triple bond of the dienophile. Obviously, the compound specified in Example 16 of the corresponding German patent has a hydroxyl group, i.e. one of the polar radicals taught by Alder to be absolutely necessary, in alpha position to the triple bond. It is of course obvious that the misprint in Example 16 of the Alder U. S. patent indicates a compound which is not provided with such a polar radical in alpha position, and therefore would be inoperative, in accordance with the teaching of the Alder patent itself.

The reference Norton is no more pertinent than Alder, since in every example cited by Norton, i.e. the examples on page 392 and involving an acetylenic compound, are organic acids in which a polar radical, as taught in the Alder U. S. patent, is in alpha position to the triple bond.

All of the references of record thus boil down to substantially the same thing—that it was known prior to applicants' invention to react cyclopentadiene with an acetylenic compound in which a polar radical is in alpha position to the triple bond. The number of these compounds were, of course, quite limited, and this was recognized in applicants' original disclosure, i.e. in lines 7-10 of page 3 and lines 12-23 of page 6. However, the references—and particularly the Alder patent—emphasize the disbelief in the art that applicants newly discovered reactions could be carried out, and the further disbelief that the new compounds produced by applicants could even exist. In view of the clear proof, by the
prior art itself, that applicants have made an in-
76 vention, it appears to be presumptuous on the part
of the Examiner to reject applicants' claim upon
such references, and particularly Alder.

Applicants' claims clearly differentiate the present invention from the compounds and methods disclosed by the prior art—and applicants wish to reiterate that Patterson does not disclose bycyclopentadiene, but merely indicates what the name of the compound would be if it were ever invented or discovered by someone. Furthermore, the present application as filed, and every claim now present in the application, is directed to a different compound or compounds and different methods than those of the prior art. Thus, claims 13, 30, 31, 32-36, 37-39, 41 and 47 are directed to compounds unknown and never before produced, while claims 20-24, 25, 42-44 and 46 are directed to processes never before known or used prior to applicants' invention. It is believed evident that the Examiner will recognize that the present claims do so differentiate. With respect to claim 13, it is believed clear that, when the unwarranted rejection on Patterson is withdrawn, for reasons pointed out above, there is nothing which would indicate that a compound having such a structural formula would or could be prepared. As discussed previously, Alder shows clearly that those skilled in the art believe that a polar radical (or stabilizing group as termed by applicants in the present specification) is absolutely necessary for a Diels-Alder reaction between an acetylenic compound and cyclopentadiene, and the polar radical must be present in alpha position. Obviously, acetylene itself does not contain any such polar radical.

77 For the reasons pointed out above, applicants are believed clearly entitled to claim the compound bicyclo-(2.2.1)-2,5,-heptadiene, and since none of the references disclose or suggest (in fact, quite the contrary) that any unstabilized derivatives of bicycloheptadiene have or could be produced, applicants are clearly entitled to broader claims. It is to be noted that each of applicants' compound claims specify compounds which do not contain the polar radical in alpha position, as required by the prior art. Furthermore, applicants are not claiming all bicycloheptadiene derivatives which do not include such a polar radical. In fact, applicants' present claims 32 and 39, for instance, specify that the ring which results from the cyclopentadiene component of the reaction has only hydrogen or an aliphatic hydrocarbon radical added to the ring, and the other two positions (indicated as Y and Z in claim 39) are limited to hydrogen and certain specific substituents. Furthermore, each of these claims further specifies that at the Y and Z positions there are no stabilizing components in alpha position to the double bond. In view thereof, it is evident not only that applicants are entitled to claims of the scope sought, but also that the claims are adequately sup-

ported by the disclosure and properly define the invention. The Examiner is in error when he states that the only acetylene compound disclosed is acetylene itself, since octyne and phenyl acetylene are clearly disclosed in lines 20-27 of page 8. Applicants genera are not speculative, nor is the exact scope of the claims difficult to determine.

Claim 32 is not alternative, since it defines the monovalent substituents at positions A and B in a clear 78 and definite manner. The meaning of the expression "the elements contained therein are limited to hydrogen, halogen, oxygen and carbon" is quite clear and definite since if a substituent does not contain any of the elements listed, then the compound containing such a substituent would not come within the scope of this claim. Furthermore, it is to be noted that if any compound did contain halogen, oxygen, sulfur, nitrogen or an aryl radical in alpha position to the double bonds, then such a compound would not come within the scope of this claim. The terminology used in this claim is certainly clear and definite, in fact, less indefinite than many of the Markush groups present in issued patents.

The claims are not unduly multiplied, since there is a clear and adequate distinction between each of the claims. Claim 40 has been cancelled, in order to reduce the number of claims, but claim 41 differs from claim 13, in that claim 13 defines the compound by the structural formula, whereas claim 41 defines the compound by its physical properties and its identity with a specific type of origin. Claim 22 differs from claim 25, and claim 21 from claim 24 by the high boiling solvent of claims 24 and 25, which is an added feature of applicant's process, in the reaction of acetylene and cyclopentadiene. Furthermore, the requirement for election of species between Claims 21 and 24 controverts the Examiner's assertion that any of these claims are too much alike.

With respect to the requirement for election of species between claims 21 and 24, applicant will elect claim 21, since it is generic to claim 24.

Since none of the process claims 20-25 have been rejected on any of the references, it is assumed that these claims contain allowable subject matter.

79 In any event, favorable action upon this application is solicited.

Respectfully Submitted

LAMPHERE & VAN VALKENBURGH
Attorneys for Applicants

By HORACE B. VAN VALKENBURGH

Denver 2, Colorado
January 15, 1952

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80 IN THE UNITED STATES PATENT OFFICE

Mail Division, U. S. Patent Office Jan. 19, 1952

Julius Hyman et al.)
Serial No. 45,574)
Filed August 21, 1948) Division 31
For DIENIC HYDROCARBONS AND)
DERIVATIVES THEREOF)

LETTER

Hon. Commissioner of Patents
Washington 25, D. C.

Sir:

It is believed that prosecution of this application will be advanced by amplification of the remarks contained in the amendment forwarded January 15, 1951, and particularly with respect to method claims 20-25, 42-44 and 46. As pointed out in the remarks accompanying such amendment, none of the references disclose or suggest that acetylene and cyclopentadiene, or an unstabilizing acetylene derivative and cyclopentadiene, has ever or could be successfully reacted, to produce a Diels-Alder adduct.

In Alder, all of the examples—and particularly Example 16—require heating for eight hours or more. It is believed evident that if anyone attempted to react acetylene itself and cyclopentadiene itself together, and heated the same for eight hours, even at the temperature of Example 16 of Alder (which is considerably less than the temperatures of applicants' Examples I and II) the acetylene, being a gas, would increase in pressure, with the probability of decomposition and the production merely of carbon from acetylene. It is to be noted
that the reaction time in applicants' Examples I
81 and II is a matter of a few minutes, rather than
hours, as in the references. Thus, what applicants have termed a dynamic system, i.e. the reactants flowing together through a heated reaction zone, at suitable pressure, and remaining in the reaction zone for only a comparatively short period of time, is thus an important contribution by applicants, and emphasizes the novelty (with respect to acetylene and cyclopentadiene) of the reaction time of one to ten minutes, as set forth in claims 21-25, inclusive. It is also to be noted that claim 20 is limited to the "dynamic" system, i.e. the reactants going together through the reaction zone.

Claim 44 is limited to the reaction being conducted in the presence of a solvent, and it is significant that, although the Examiner relies on Example 16 of Alder, there is no solvent used in Example 16.

As discussed in the remarks accompanying the amendment forwarded January 15, 1952, Alder teaches the necessity for the presence of a polar radical, and claims 42-45 specifically exclude the presence of such a polar radical. Claim 46 specifies the particular compounds involved in the reaction, further specifies an excess of the acetylenic compound, and sets forth the substituents of the cyclopentadienic and acetylenic compounds in Markush groups. In addition, the acetylenic compounds obviously do not contain any polar radicals.

Claim 47 is dependent on claim 46, and is directed to the 1:1 adduct produced by the process of claim 46. While the Patent Office ordinarily objects to allowance of a claim to the product of a process, until the product claims in this case are allowed, it is submitted that claim 47 should be considered. 82 Attention is further directed to the counts of Interference No. 83,410, the first of the present counts being a process claim and the second count being a claim to the product of the process. Since these counts have recently been scrutinized rather carefully by the Examiner, it is evident that it is policy of the Patent Office to allow this type of claim in many instances.

Respectfully Submitted,

Lamphere & Van Valkenburgh
Attorneys for Applicants
By Horace B. Van Valkenburgh

Denver 2, Colorado
January 16, 1952

* * * *

88 Responsive to amendment filed Jan. 16 and letter filed Jan. 19, 1952.

Claims 13, 32 to 35, 39, 41 and 47 are rejected as being fully met by Patterson, of record. It is still considered that the mere disclosure of a formula serves to anticipate a claim to the compound. The formula embodies the inventive concept and the disclosure of a concept is a valid reference.

Claims 13, 20, 23, 33, 34, 35, 41 and 45 are rejected as lacking invention over Alder et al or Norton, of record. It is still considered that no invention is involved in trying acetylene as the reagent, where acetylenic compounds, broadly, are suggested in the prior art.

Claims 32, 39, 42, 44, 46 and 47 are rejected as being fully met by Example 16 of Alder et al and as lacking invention over Norton, for the reason indicated in the preceding paragraph. It is still considered that neither applicants' inability to find Alder's starting material in the literature nor the difference noted in Alder's German patent can be given any weight in view of the clear teaching of the example.

Claims 32 to 35, 39 and 42 to 47 are rejected as not being adequately supported by the disclosure and
89 as improperly defining the invention. It is considered that a specific disclosure restricted to acetylene does not warrant the broad and speculative genera here claimed, the exact scope of which is difficult, if not impossible to determine. The mere mention of two other acetylenic compounds (both hydrocarbons) does not materially improve applicants' position.

Claim 32 is again further rejected as being alternative in claiming a compound "and its derivatives" without recourse to proper generic language.

All the claims are rejected on the ground of undue multiplicity. It is still considered that considerable duplication exists. Claim 41 is still considered to be of the same scope as claim 13; claim 22 the same scope as claim 21; and claim 25 the same scope as claim 24. Claims 33, 34 and 35 involve considerable overlapping. Claims 39, 42, 46 and (in effect, although not in proper Markush form) 32 to 35 involve Markush groups of varying scope. Claim 47 is product-by-process claim which may not be presented along with true product claims.

Claims 30, 31, 36, 37 and 38 are again rejected as not being readable on the elected species.

Claim 21 is now considered generic to claim 24, as urged by applicants.

This rejection is made *FINAL.*

/s/ A. M. Boettcher
Actg. Examiner

LZ:hs
LZ

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177 A

RVH.
Paper No. 15
cld
/D

IN THE UNITED STATES PATENT OFFICE

NO 2 '52

Division 31

Amdt D

In re Application of)
JULIUS HYMAN et al)
Serial No. 45,574) Division 31
Filed August 21, 1948)
For DIENIC HYDROCARBONS AND DERIVATIVES THEREOF)

Chicago, Illinois,
November 17, 1952

Honorable Commissioner of Patents
Washington 25, D. C.

Sir:

In response to the final Action dated September 11 1952, amendment is made as follows:

Entered per Spr.
3-10-53.

In the specification, cancel the following: Page 12, line 10, sentence starting "This if further . . . " to end of page, and page 13, lines 1 to 13 including the structural formula immediately following.

Cancel claims 20, 22-24, 30-39, and 41-47 without prejudice.

Claim 21, line 1, change "the" to --a--
line 2, strike out "of claim 13"

Add the following claim:

D'

--48. The continuous process for preparing bicyclo-(2.2.1)-2,5-heptadiene which comprises causing cyclopentadiene and acetylene in mole ratios between one to one and one to ten to flow together through a reaction zone maintained at a temperature between 150° and 400°C and a pressure between atmospheric and 250 pounds per square inch gauge at such a rate as to cause the reactants to remain in the reaction zone for a period of time between one and fifteen minutes thereby producing the Diels-Alder adduct formed by the reaction of one mole of cyclopentadiene with one mole of acetylene.--

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91 REMARKS

The courtesy of an interview extended by the Examiner to counsel for applicants is respectfully acknowledged.

Reconsideration of the final rejection and entry of the present amendment for the purpose of placing the application in condition for allowance or in better condition for appeal is respectfully requested.

All of the claims in the case have been cancelled with the exception of claim 13 and claims 21 and 25. A new claim 48 has been added.

At the interview the Examiner indicated that one of claims 21 and 22 which were considered duplicates, and one of claims 24 and 25 which were considered duplicates, will be regarded allowable if a selection is made. Accordingly, method claims 21 and 25 have been retained. Although not discussed with the Examiner at the interview, an additional method claim 48 has been added, patterned substantially along the lines of claim 21 considered allowable. In this newly added claim, although the critical process steps have been retained, they have been somewhat broadened, based on the specification. Thus the temperature has been broadened to 150° to 400° C based on line 9 of page 7 of the specification. The operative pressure has been broadened to atmospheric to 250 pounds per square inch gauge, likewise based on lines 10 and 11 of page 7 of the specification. The time of reaction has also been increased to 1 to 15 minutes based on Table I appearing on page 9 of the specification wherein the process is shown in the specific examples to be operable at 14 minutes.

92 With respect to product claim 13, it is respectfully submitted that this claim is patentable over Patterson for the reasons repeatedly expressed in the previous amendments.

It is respectfully submitted, and the Examiner indicated, that this claim presents subject matter which is distinct from Alder et al or Norton in that the product claimed is a hydrocarbon whereas the acetylenic reactants of Alder et al and Norton all contain oxygen as do their resultant end products, thus taking them out of the class of hydrocarbons.

As further pointed out to the Examiner, the product of claim 13 results from a characterizing process such as set forth in claims 21, 25 and 48, as distinguished from Alder et al. In Alder et al. all of the examples require heating for a long period of time in an autoclave, i.e., under static conditions, for extended periods, such as upwards of five hours, and Example 16 teaches heating for eight hours. It is believed evident that if anyone attempted to react acetylene itself and cyclopentadiene itself together, and heated the same, say for eight hours, the acetylene, being a gas, would increase in pressure with the probability of decomposition and the production merely of carbon from acetylene. Applicants' process requires a matter of a few minutes rather than hours as distinguished from the reference, and applicants accomplish their process to result in the production of the claimed product by employing a dynamic system; i.e., the reactants flowing together through a heated reaction zone.

93 Norton is no more pertinent than Alder since the products he shows are of a class different from the applicants' products, as previously pointed out, and further Norton shows no compounds other than those whose previous existence is clearly set forth and distinguished from in the present application. The existence of the Norton compounds does not suggest that the compound of applicants' claim 13 is capable of existence or can be prepared.

In addition to the uses set forth in the specification, the compound of claim 13 is an important intermediate in the production of the now well-known, universally accepted and widely employed insecticide—dieldrin and aldrin. The use of the presently claimed compound as an intermediate in the preparation of aldrin is described and claimed in applicants' copending application Serial No. 45,573, filed August 21, 1948, and the use thereof in the preparation of dieldrin is more particularly described and claimed in the copending application of Samuel B. Soloway, Serial No. 63,626, filed December 4, 1948.

In view of the foregoing the Examiner indicated that he would favorably consider removal of Alder et al and Norton as references against claim 13.

As pointed out to the Examiner, the specification has also been amended to delete Example 3 which is in error in that the teachings of the example did not actually result in the compound described in said example, and the attention of the Examiner is drawn to the fact that claim 14, directed to the compound of Example 3, was withdrawn by previous amendment when the error came to applicants' attention, although inadvertently the specification was not previously amended.

94 In view of the foregoing, favorable reconsideration is earnestly solicited.

Respectfully submitted,

Gary, Desmond & Parker
By James W. Parker

P:ar

95 Paper No. 16

Mailed February 24, 1953

* * * *

Responsive to amendment filed November 18, 1952.

The amendment has not been entered as it does not place the case in condition for allowance, claim 13 being still considered to be unpatentable over the art of record.

Moreover, the amendment will not be entered for purposes of appeal, should one be taken, as proposed claim 48 would raise questions of new matter and adequate support as to the numerical limitations. Claim 48 is limited to one specific reaction carried out in what applicant terms "a dynamic system." The reaction conditions applicable to this species are disclosed only in Examples I and II and original claims 21 and 25.

The statutory period for response runs from September 11, 1952, the date of the final rejection.

/s/ E. W. Hutchison
Examiner

LZ/cjn

LZ

96 Paper No. E

Mailed March 10, 1953

* * * *

Chicago, Illinois,
February 27, 1953.

Honorable Commissioner of Patents
Washington 25, D. C.

Sir:

In response to the Office Action of February 24, 1953, and supplementing the amendment filed November 18, 1952, please make the following additional amendments:

In the specification,

Page 9,

line 8, after "acetylene" insert—in mole ratios between one to one and one to ten—

line 9, before "suitable" insert—temperature between 250 and 375°C and at a—

[E 1] same line, after "pressure" insert—lying between 30 and 150 pounds per square inch gauge—

line 10, after "period" insert — lying between about one and about fourteen minutes—

Claim 21,

line 8, change "ten" to—about fourteen—

Claim 25,

line 10, change "ten" to—about fourteen—

Cancel proposed claim 48 without prejudice.

REMARKS

The courtesy of the interview extended by the Examiner to counsel for applicants is respectfully acknowledged.

97 Entry of the within amendment to place the case in better condition for appeal, or for allowance, is respectfully requested. Formal notice of appeal is transmitted herewith.

It is believed that with the present amendments, the remaining portions of the amendment filed November 18, 1952 can now be entered, and the remarks therein made given further consideration.

Claims 21 and 25 have been amended with respect to the upper limit of the reaction-time period, based on the table in Example I. In view of the Examiner's suggestions, general reaction conditions as to time, porportions, temperature, and pressure generally contained in the original claims 21 and 25 have been inserted in the specification in the preamble to Example I on page 9.

Entry of the foregoing amendment should render process claims 21 and 25 allowable.

It is also again submitted, as stated to the Examiner at the last interview, that it is believed that in view of the cancellation of the broader product claims, such references as Alder et al or Norton are clearly no longer applicable to the remaining product claim 13 which is specific to a hydrocarbon. Applicants of course remain of the further opinion that claim 13 is also patentable over Patterson for the reasons previously expressed at length with respect to this reference.

Respectfully submitted,

Gary, Desmond & Parker
By James W. Parker

P:ar

98 Mailed March 4, 1953

* * * *

APPEAL TO THE BOARD OF APPEALS

Honorable Commissioner of Patents
Washington 25, D. C.

Sir:

In the matter of the above-entitled application and in response to the Office Action of September 11, 1952, appeal is hereby taken to the Board of Appeals.

The following reasons are urged in support of this appeal:

1. The Examiner erred in finally rejecting the claims on the references and for the reasons of record.

2. The Examiner erred in not allowing the application.

An appeal fee of $25 is attached hereto.

Respectfully submitted,

Gary, Desmond & Parker
By James W. Parker

Chicago, Illinois,
February 27, 1953.

99 Paper No. 19

Mailed March 12, 1953

* * * *

Responsive to amendment filed March 2, 1953 and further responsive to amendment filed November 18, 1952.

The amendments referred to have been entered for purposes of appeal.

Claims 21 and 25 are considered allowable.

However, in claims 21 and 25, line 3, and the amendment on page 9, line 8, the expression "between one to one to one to ten" should be changed to *between one to one and one to ten.*

Applicants' brief is due within the period provided by Rule 192.

/s/ E. W. Hutchinson
Examiner

LZ/cjn
LZ

Paper No. 20

Mailed March 19, 1953

* * * *

Chicago, Illinois,
March 16, 1953

Honorable Commissioner of Patents
Washington 25, D. C.

Sir:

In response to the Advisory Patent Office Action of March 12, 1953, please enter the following amendment: In Claims 21 and 25, line 3, and the amendment on page 9, line 8 of the specification, change the expression "between one to one to one to ten" to—between one to one and one to ten—

REMARKS

The foregoing amendment is made pursuant to the helpful suggestion of the Examiner, which is appreciated.

Respectfully submitted,

Gary, Desmond & Parker

By James W. Parker
Attorneys for Applicants

P:ar

BOARD OF APPEALS
APR 0

186 A

#21
Brief

IN THE UNITED STATES PATENT OFFICE

In re Application of
JULIUS HYMAN et al
Serial No. 45,574
Filed August 21, 1948
For DIENIC HYDROCARBONS AND DERIVATIVES THEREOF

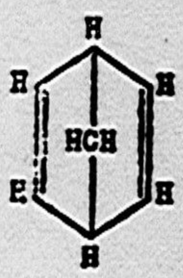
On Appeal before the Board of Appeals
Appeal No.36,860

BRIEF FOR APPLICANTS

This is an appeal from the final rejection by the Primary Examiner of Claim 13, the sole product claim now in the application. The application additionally contains two process claims, namely 21 and 25, both considered allowable, for making the product of the finally rejected claim.

The finally rejected claim is as follows:

> 13. As a new composition of matter, the hydrocarbon bicyclo-(2.2.1)-2,5-heptadiene possessing the structural formula



Subject Matter of the Invention

The invention, as exemplified by the three claims of the application, relates to the production of a novel chemical compound, namely a specific bicyclic diolefinic

102 hydrocarbon which came into existence for the first time as a result of the novel reaction set forth in applicants' presently allowed process claims.

The product of Claim 13 was unknown prior to applicants' invention and was not known to be capable of existence until it came about as a result of applicants' admittedly novel method for reacting cyclopentadiene and acetylene by adduction under the specific and controlled conditions described in Examples I and II of applicants' specification, and particularly pointed out in Claims 21 and 25.

The claimed product is valuable as an intermediate in the synthesis of a large number of new pure chemicals and is in large scale commercial production by applicants' assignee of record, by means of the claimed process, where it is further employed as an intermediate in the production of the presently well known and widely accepted insecticides—dieldrin and aldrin.

The References

In support of his rejection of the claim, the Examiner relies on the following references:

Patterson et al	"The Ring Index" page 110 (1940)
Alder et al	U.S. patent No. 2,352,606
Norton et al	"Chemical Reviews" Vol. 31, pages 387-92 (1942)

The Rejection in General

The claim is rejected as allegedly being fully met by Patterson on the theory that the mere disclosure of a formula serves to anticipate a claim to the compound, the Examiner taking the position that the formula 103 embodies the inventive concept and that the disclosure of such alleged concept is a valid reference. Although this reference will be further discused, it should be pointed out here that the "mere disclosure of a formula" to which the Examiner refers is not a formula for producing the claimed compound, but is merely a naked statement, taken out of context, giving the Geneva system name of the ring portion of another compound, without description of physical or chemical properties, and utterly without any teaching or suggestion as to how this residual ring may be produced alone, or whether is as any utility.

The claim stands further rejected as allegedly lacking invention over Alder et al or Norton on the ground that the Examiner considers that no invention is involved in trying acetylene as the reagent, where acetylene compounds, broadly, are suggested by the prior art. Although these references will be hereinafter more fully discussed, neither their pertinency nor any inferences which the Examiner tries to draw from them are understood, since these references admittedly do not make use of acetylene nor do they teach or suggest the production of the specific hydrocarbon here in issue.

The Patterson et al Reference

Patterson is a compilation of ring systems. The presence of particular ring systems in that reference does not imply, and is not intended to imply, either that the apparent ring shown does, *per se,* exist, or can *per se* exist. Patterson is concerned with a particular aspect of organic chemistry, namely, the nature of the
104 rings which may be present in organic molecules, eliminating for his purpose any other parts of the compound which may actually be present, and employs the residue, out of context, solely for his illustrative purpose, and nothing else. This is apparent from the last three lines of page 110 of Patterson to which the Examiner refers, and is quoted as follows: "Bicyclo (2.2.1)-2,5-heptadiene. Ann.490,238-9 (1931)." Recourse to the source noted by Patterson, a translation

of which was filed as part of Paper No. 5 on November 14, 1950, shows an article by Diels and Alder discussing the adduction of cyclopentadiene and acetylene dicarboxylic acid which gives rise to a dicarboxy bicycloheptadiene. Patterson, for his purpose, writes of this substance as though it were simply a bicycloheptadiene, i.e., bicyclo-(2.2.1)-2,5-heptadiene, but fails to show where the latter was *per se* ever disclosed in the prior art. Although the Examiner refers to the last three lines of Patterson, page 110 (Paper No. 4), he likewise takes the statement of the Geneva name for the ring portion of dicarboxy bicycloheptadiene, outof context and in disregard of the terminal reference portion of his own citation. It is respectfully submitted that the Examiner may not fairly do this. The "inventive concept" of which the Examiner speaks must be considered in its entirety and its source not chopped off at a point where inconsistency in his position might become apparent.

The mere recitation by Patterson of Bicyclo (2.2.1)-2,5-heptadiene, by which he intended to describe the ring portion of dicarboxy bicycloheptadiene, and nothing else, cannot be said to fairly disclose the separate, stable,
105 novel and useful compound of applicants' claim,
without any attached elements or groups, which changes the entire character of the compound.

Further, the purported disclosure by Patterson or the Examiner's reliance thereon out of context, cannot be fairly said to come within the prohibitions of the Statute, since mere designation of a chemical term attributed to a portion of a compound, without giving the chemical or physical properties of said portion when standing alone, or without direction or suggestion as to how it might be prepared or used alone, cannot be fairly said to be a description of a composition of matter in a printed publication coming under R.S. 4886. It is further submitted that mere inspection of the Geneva name, as set forth in the cited portion of Patterson, could not teach one skilled in the art how to prepare this compound, i.e., the bicyclic ring compound, without substituents, nor did it do so until the product unexpectedly resulted from applicants' novel method, even though Diels and Alder wrote their article in 1931 and Patterson et al compilation was published in 1940.

Although it is not difficult to react derivatives of acetylene with cyclopentadiene, reaction of acetylene *per se* with cyclopentadiene is an entirely different matter. The solubility of acetylene in almost all liquids is relatively low at elevated temperatures unless high pressure is employed. It is well known, however, that acetylene decomposes with explosive violence when subjected simultaneously to both elevated temperatures and pressures. 106 Applicants, however, were able to successfully handle acetylene and directly adduct it with cyclopentadiene by employing a "dynamic" system; that is, by employing a flowing vapor phase or mixed phase system with the reactants continuously passing through a hot reaction zone with a short period of residence time therein. Only then, and for the first time, was Bicyclo (2.2.1)-2,5-heptadiene brought into existence and identified by means of its chemical and physical properties and so recognized and described by applicants. This could not be done from Patterson or from the source article by Diels and Alder, and therefore Patterson cannot be fairly said to constitute a printed publication of the claimed composition, for such was not Patterson's intention nor did he do so within the intent and meaning of R.S. 4886.

Cases Cited by Examiner in Support of Patterson as a Reference and Applicants' Arguments in Reply

Following the Office Action of May 17, 1950, an oral interview was had with the Examiner at which time he referred to the following decisions which, in his opinion, support the rejection on the basis of the Patterson publication:

Eastman Kodak Company v. Coe, 51 USPQ 407 (D.C. Dist. Col. 1941) See 135 Fed. (2) 836
In re Von Bramer et al, 53 USPQ 345 (CCPA 1942)
In re Crosley et al, 72 USPQ 499 (CCPA 1947) 1947 C.D.
Ex parte Sloan, 73 USPQ 266 (P.O.Bd. App.1947)
In re Stoll, 73 USPQ 440 (CCPA 1947)

Examination of these cases clearly demonstrates that they came to their conclusions of nonpatentability not on the basis of mere publication, but on additional controlling facts at variance with those of the present application.

107 In considering the foregoing citations, it must be kept in mind, as previously pointed out, that Patterson by his recitation of Bicyclo (2.2.1)-2,5-heptadiene was merely applying chemical nomenclature, in accordance with his system, to the ring portion of another compound described earlier by Diels and Alder. He did not indicate, nor did he intend to indicate, that Bicyclo (2.2.1)-2,5-heptadiene did or could exist as an independent compound, he did not teach or suggest a method by which it could be made or its chemical or physical properties, nor did he ascribe any utility thereto. In fact, it was unknown prior to applicants' invention, and the mere statement in Patterson was not adequate to teach or suggest to one skilled in the art that the compound could exist or how it could be made. By Patterson's reference to his source, one skilled in the art would be led to a contra-indication.

Thus, in *Eastman Kodak Company* v. *Coe* the references relied on not only disclosed the compounds claimed by the applicant Bean, but also described their properties and particular utility as stabilizing agents for gasoline.

The same applies to *In re Von Bramer et al* where the same references were relied on. The court here additionally pointed out that even though no method for making the compounds was described, the compoonds were "generally capable of synthesis by recognized classical organic reaction" and that "the suggestion to use this substance as claimed is clear."

108 This is quite remote from the present situation where Patterson does not give the property of the ring which he names, does not ascribe any utility to it or suggest any use therefor, and the compound is certainly not one capable of synthesis by a recognized or classical organic reaction. Taken in full context, the Patterson reference would lead one away from synthesis of the ring *per se* as an independent compound.

The court quoted with approval from the Examiner's statement as follows:

> "Applicant's argument that a name without further description given to a substance fails to identify or classify it and therefore fails to add to the prior knowledge in any way, is often true."

It is submitted that the foregoing is a clear indication that the holding might have been different had the facts presented a clear-cut case such as that which exists with the present applicants.

That this is so further clearly appears by reference to the earlier case of *Eastman Kodak Company* v. *Coe,* 50 USPQ 43. This case is appropriately cited as authority since the Examiner likewise relies on the later case of *Eastman* v. *Coe,* also decided by the District Court of the District of Columbia. Although the District Court is the later case, and the CCPA in the case of *In re Von Bramer* had ample opportunity to reject the law of the earlier *Eastmak Kodak* v. *Coe* case, they did not do so. It is therefore submitted that the controlling law as applied to the facts in the present instance must be the principle laid down by the earlier case where the court said:

> 109 "I think that the production of a new chemical compound, even though someone has stated that such a compound may exist, is an invention within the meaning of the patent laws and that plaintiff is entitled to the relief sought."

It will be noted that applicants' position is even stronger than this, since Patterson did not even suggest that the ring might exist as a compound.

The case of *In re Crosley et al* relates to the attempt to claim a purified compound having certain therapeutic properties where the prior art showed the same unrefined compound with the recognition that it had the same therapeutic value. The court in relying on *In re Von Bramer et al* and on *In re Warden et al,* 8 USPQ 515, which is another purification case, indicated that these were instances "where a product is clearly disclosed in a publication." The facts are thus easily distinguished from the present case where *clear* disclosure is absent, and thus these cases are clearly not pertinent.

Ex parte Sloan is another case where the prior art relied on indicated that the compound had the properties claimed for it by Sloan and that the compound could be made by methods well known to the art, the court stating in support of its opinion: "In the reference the use of the compounds as antioxidants has at least been indicated." For these reasons it is again clearly apparent that this case is not applicable.

In re Stoll et al is likewise a situation where the refer-
ence did more than merely name a compound, the
110 court finding that the starting materials employed
by the applicant and by the reference were the same,
and therefore one employing the same starting materials
in applicants' process would produce the same product,

affirming the position taken by the Examiner that a person skilled in the art by following the teachings of the Kharasch reference would obtain the claimed compound. This is easily distinguished from the present situation since one employing the starting materials of Diels and Alder, referred to by Patterson, would certainly not get the presently claimed compound, nor does the Examiner here take such position.

Other and subsequent decisions, purportedly holding that mere disclosure of the composition is sufficient to anticipate a claim for it, upon further study clearly disclose that in each instance there were added facts and circumstances in addition to the "mere disclosure of the composition" and in each instance certainly more than the mere naming of a portion of a prior different compound, as is the present situation.

The prohibition in R.S. 4886 is to prevent the appropriation of or the withdrawal from the public something that was dedicated to it, or which it already had in its possession. The Patterson publication gave nothing to the public. Standing alone, it did not and could not enable one skilled in the art to produce the described ring as an independent product, nor did Patterson purport to do so. Only upon the advent of applicants' discovery was anything made available to the public.

111 The mere appearance in a publication of the name of a chemical compound is not, and should not be, sufficient to defeat a claim to a novel chemical compound, in the absence of anything further. None of the cases cited by the Examiner nor any which have come to the attention of counsel have denied patentability on a situation the same as that with which applicants are confronted. Each case must be considered on its own facts, and it is submitted that the factual situation of the present application has never been adversely adjudicated.

The Supreme Court of the United States in *Eames* v. *Andrews,* 122 U.S. 40, 66; 30 L.Ed. 1064 (1886), in holding the claims of a patent valid over prior art publications, defined the controlling law as follows:

> "The rule governing defenses alleging the invalidity of the patent by reason of prior printed publications was stated by *Mr. Justice* Clifford in *Seymour* v. *Osborne,* 78 U.S. 11 Wall. 516, 555 [20:33, 42] in this language: 'Patented inventions cannot be superseded by the mere introduction of a foreign publication of the kind, though of prior date, unless the description and drawings contain and exhibit a substantial representation of the patented improvement, in such full, clear, and exact terms as to enable any person skilled in the art or science to which it appertains to make, construct, and practice the invention to the same practical extent as they would be enabled to do if the information was derived from a prior patent. Mere vague and general representations will not support such a defense, as the knowledge supposed to be derived from the publication must be sufficient to enable those skilled in the art or science to understand the nature and operation of the invention, and to carry it into practical use. Whatever may be the particular circumstances under which the publication takes place, the account published, to be of any
> 112 effect to support such a defense, must be an
> account of a complete and operative invention, capable of being put into practical operation.'
>
> "The same rule was repeated by *Mr. Justice* Strong in the opinion of the court in *Cohn* v. *U.S. Corset Co.;* 93 U.S. 366, 370 [23:907, 908], as follows: 'It must be admitted that, unless the earlier printed and published description does exhibit the later patented invention in such a full and intelligible manner as to enable persons skilled in the art to which the invention is related to comprehend it without assistance from the patent, or to make it, or repeat the process claimed, it is insufficient to invalidate the patent.' This rule was affirmed in *Downton* v. *Yeager Milling Co.* 108 U.S. 466, 471 [27:789, 791]."

It is submitted that the Patterson publication is not an account of a complete and operative invention capable of being put into practical operation, in that it does not describe applicant's claimed product in such full, clear and exact terms as to enable any person skilled in the art or science to which it appertains to make and practice the invention, without applicants' assistance. When measured by the foregoing requirements laid down by the Supreme Court it is evident that Patterson is insufficient to deny applicants the reward to which they are justly entitled.

The Alder et al and Norton References

Neither of these references show the specific compound of Claim 13. Neither of them teach or suggest a method for producing this novel hydrocarbon. Neither of them teach or suggest the use of acetylene *per se* as one of the reactants, nor do they teach or suggest conditions necessary to combine acetylene with cyclopentadiene so
113 as to produce their claimed adduct.

Although the Examiner takes the position, after the event, that no invention is involved in trying acetylene as the reagent, where acetylene compounds, broadly, are suggested by the prior art, it is noteworthy that the references themselves indicate the contrary.

Thus Alder et al state that in order to accomplish their so-called "diene-synthesis" it is necessary to employ a compound containing an acetylene group wherein said unsaturated linkage is likewise conjugated with another double bond for the purpose of activating the unsaturated linkage (page 1, second paragraph), or that the acetylene compounds must be those which contain polar radicals separated from the threefold or acetylene linkage by one carbon atom (page 1, third paragraph). Obviously acetylene itself does not respond to such requirements, and such requirements certainly would not suggest that one

skilled in the art try acetylene *per se,* as the Examiner now suggests. The reaction conditions specified by Alder et al are certainly not conducive to the adduction of cyclopentadiene and acetylene alcohol for eight hours. It is heating for a long period of time in an autoclave, i.e., under static conditions, for extended periods such as upward of five hours, and Example 16 teaches heating cyclopentatiene and acetylene alcohol for eight hours. It is believed evident that if one attempted to react acetylene with cyclopentadiene, and heated them, say for eight hours, the acetylene, being a gas, would increase in pressure
114 with the probability of decomposition and the production merely of carbon from acetylene. Applicants accomplished the reaction by employing a dynamic system, that is, one where the reactants are flowed together through a heated reaction zone in a matter of a few minutes, all clearly distinct from anything suggested by the reference.

Norton is no more pertinent than Alder et al, since the examples on page 392 and involving an acetylene compound are organic acids in which a polar radical, as taught in the Alder et al patent, is in alpha position to the triple bond. There is no suggestion here as to the use of acetylene *per se,* nor any reaction thereof or condition for reacting it with cyclopentadiene such as might lead to applicants' claimed novel hydrocarbon.

The Examiner's rejection of Claim 13 as lacking invention over either Alder et al or Norton is therefore clearly unwarranted.

Summary

It is respectfully submitted that the references do not describe the invention in such full, clear, and intelligible terms as to enable persons skilled in the art to comprehend it or to produce the product claimed, without applicants' assistance, and they should therefore be withdrawn and the claim allowed.

Respectfully submitted,

GARY, DESMOND & PARKER
By: JAMES M. PARKER

Chicago, Illinois,
April 27, 1953

115 Mailed April 23, 1953

* * * *

Chicago, Illinois,
April 27, 1953

Honorable Commissioner of Patents
Washington 25, D. C.

Sir:

Enclosed herewith are three copies of brief for applicants in the above-entitled matter.

An oral hearing is requested.

Respectfully submitted,

GARY, DESMOND & PARKER
By: JAMES M. PARKER
Attorneys for Applicants

[redacted]

Insecticide Recommendations

OF THE ENTOMOLOGY RESEARCH BRANCH FOR THE CONTROL OF INSECTS ATTACKING CROPS AND LIVESTOCK

1956 Season

AGRICULTURE HANDBOOK No. AH 103
Agricultural Research Service
and Federal Extension Service
U.S. DEPARTMENT OF AGRICULTURE
March 1956

PRECAUTIONS

Insecticides are poisonous. Handle them with care. Follow the directions and heed all precautions on the container label.

When handling or mixing concentrated insecticides, avoid spilling them on your skin and keep them out of your eyes, nose, and mouth. If any is spilled on the skin or clothing, wash it off and change your clothing immediately. Wear a respirator and goggles when you are working with concentrated sprays or dusts.

Many of the new insecticides can be absorbed directly through the skin in hazardous quantities. In applying them, try to keep them off your skin and away from your eyes, nose, and mouth. Work on the windward side of the crop or animal being treated. When you have finished the job, wash all exposed surfaces of the body with soap and water. Change your clothing if any insecticide is spilled on it.

Parathion, methyl parathion, EPN, TEPP, and demeton are extremely poisonous. They should be applied only by a person thoroughly familiar with their hazards who will assume full responsibility for safe use and comply with all the precautions on the labels.

Store insecticides in closed containers in a dry place where children, irresponsible persons, and animals cannot reach them. Keep ethylene dibromide in a cool place away from dwellings. Be sure that insecticides are clearly labeled.

The fumigants carbon disulfide and ethylene dibromide are very poisonous to man and animals. They should be handled with every possible precaution and only by individuals thoroughly familiar with their hazards. Carbon disulfide is inflammable and explosive. Never open a container of it where there is little air in circulation or expose it near fire in any form. Do not transfer ethylene dibromide from one container to another in a closed room. Do not breathe the fumes.

If you spill one of the fumigant liquids on your skin wash it off promptly with soap and water. Remove immediately any clothing or shoes that have been wet with ethylene dibromide; otherwise severe blistering will result.

If you accidentally swallow an insecticide, induce vomiting by taking 1 tablespoonful of salt in a glass of warm water. Repeat if necessary. Call a doctor.

To protect fish and wildlife, be careful not to contaminate streams, lakes, or ponds with insecticides. Do not clean spraying equipment or dump excess spray material near such water. Avoid getting this material onto pasture grass or feed.

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. - Price 50 cents

INSECTICIDE RECOMMENDATIONS OF THE ENTOMOLOGY RESEARCH BRANCH FOR THE CONTROL OF INSECTS ATTACKING CROPS AND LIVESTOCK

1956 Season

Foreword

The recommendations of the Entomology Research Branch, Agricultural Research Service, as of March 15, 1956, for the chemical control of insects and mites that attack food, feed, and fiber crops and livestock are presented in these tables. The information was compiled by the various Sections of this Branch in consultation with the Pesticide Regulation Section of the Plant Pest Control Branch and the Federal Extension Service, and was coordinated by Arlo M. Vance.

It is emphasized that these recommendations are those made by the Entomology Research Branch. There are other recommendations and other materials registered for use that will leave no residues or residues within the tolerances set under Public Law 518, the Miller amendment to the Federal Food, Drug, and Cosmetic Act.

Official tolerances for a number of the insecticides now recommended have not yet been announced by the Food and Drug Administration. As they are announced, the Department will review the recommendations and make such changes as are necessary to insure that residues do not exceed the tolerances. Since the status of many chemicals is changing rapidly, we suggest that you keep in touch with the Department of Agriculture, your land-grant college, or manufacturers of specific products for up-to-date information.

Most of the recommendations listed in this Handbook appear in one or more of the references cited. However, some of them have been modified since the publications were issued, and others are new and have not previously appeared in print. The recommendations are limited to the 1956 growing season.

E. F. Knipling, Chief
Entomology Research Branch

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EXPLANATION OF TABLES

"Formulation" refers to the form or concentration of the undiluted insecticide to be used at the designated dosage. Dusts and granules are usually applied at the strength purchased. Unless otherwise indicated, emulsifiable concentrates and wettable powders are to be diluted with water, the amount depending on the output of the equipment, and applied as sprays.

A dash in the tolerance column means that no tolerance had been established at the time these recommendations were prepared. A dash in other columns indicates that there are no data for the insecticide that is opposite it on the same line.

The following abbreviations are used:

Bait	B
Dust	D
Emulsifiable concentrate . .	EC
Granules	G
Spray.	S
Wettable powder.	WP

The titles of the numbered references are given on pages 95-97.

LEGUME AND GRASS INSECTS

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Dosage (Formulation per acre unless otherwise indicated)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
ALFALFA								
Alfalfa caterpillar	Methoxychlor	100	25% EC	1½-2 qt.	If there are 10 or more caterpillars per sweep of net, usually when alfalfa is 1/3 grown.	7		L 325
Alfalfa weevil								
Larvae	Aldrin	—	EC or 1% D	2 oz. aldrin	In May or June.	15	—	PS 28, L 368, Utah Cir. 135 and Ext. Cir. 213
On hay crop in West	Heptachlor	0.1	EC or 2.5% D	3/4 oz. heptachlor	do.	3	—	
	Lindane	—	EC or 1% D	1-2 oz. lindane	do.	15	—	
	Methoxychlor	100	EC or 10% D	1-2 lb. methoxychlor	do.	7	—	
	Parathion	1	EC or 1% D	4 oz. parathion	do.	15	See Precautions.	
On seed crop in West	DDT	—	25% EC 10% D	3-4 qt. 20 lb.	As soon as buds appear.		Do not feed treated alfalfa to livestock or poultry.	
	Dieldrin	—	EC	4 oz. dieldrin	—		do.	
On crop in East	Heptachlor	0.1	EC	4 oz. heptachlor	Last half of April when plants are 10-15 in. tall; second application not later than 2 weeks before harvest; also to stubble as soon as crop is removed.	7		
Adults	Dieldrin	—	EC	4 oz. dieldrin	In spring when alfalfa is ½-2 in. tall.	—	Do not pasture alfalfa treated with dieldrin until after first cutting.	
On crop in West	Heptachlor	0.1	EC 2.5% D	4 oz. heptachlor 12 lb.	do.	7		

LEGUME AND GRASS INSECTS (continued)

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Dosage (Formulation per acre unless otherwise indicated)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
ALFALFA (con.)								
Grasshoppers	Aldrin	—	EC	1½-2 oz. aldrin	Treat field margins and ditchbanks as well as alfalfa.	15	Do not feed alfalfa to dairy animals, animals being finished for slaughter or poultry if it has been treated with chlordane at recommended dosages, with aldrin at more than 2 oz., with dieldrin at more than 1 oz., or with toxaphene at more than 1½ lb. per acre. Do not feed alfalfa for 10 days after treatment with heptachlor at more than 4 but not over 8 oz. per acre.	Utah Cir. 135, FB 2064
	Chlordane	—	EC	½-1 lb. chlordane		—		
	Dieldrin	—	EC	3/4-1 oz. dieldrin	do.	30		
	Heptachlor	0.1	EC	2-4 oz. heptachlor	do.	7		
	Toxaphene	—	EC	1-1½ lb. toxaphene	do.	40		
	Same insecticides	—	D	Increase dosage by 50%	do.	—		
Lygus bugs, leafhoppers, thrips, and yellow-striped armyworm (On seed crop in West)	DDT	—	25% EC 10% D EC	3-4 qt. 20 lb. ½ lb. DDT	As soon as buds appear. do. During bloom.	—	Do not feed alfalfa treated with toxaphene at a dosage exceeding 1½ lb. per acre, or with DDT or dieldrin, to livestock or poultry. When alfalfa is in bloom, apply toxaphene spray or dust or DDT spray in evening or morning when bees are not active.	Utah Cir. 135, Ext. Bul. 221
	Dieldrin	—	EC (1½ lb./gal.)	1½ pt.	Only in early bud stage.	—		
			1.5% D	17 lb.	do.			
	Toxaphene	—	EC 10% D	1½ lb. toxaphene 20 lb.	During bloom 3-4 weeks after bud-stage treatment.	40 —		
Meadow spittlebug	Spring treatment							
	Lindane	—	EC	½ lb. lindane	Within week after eggs begin to hatch, when alfalfa is 4-6 in. high, from early April to May 20.	14	--	L 341, Ohio Pub. Ser. 22
	Methoxychlor	100	EC	1 lb. methoxychlor		7	—	
	Toxaphene	—	EC	1½ lb. toxaphene		40	—	
	Fall treatment							
	DDT	—	EC	1½ lb. DDT	In fall.	—	Do not feed forage treated with DDT to livestock.	
	Methoxychlor	100	EC	1½ lb. methoxychlor	do.	7		

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Dosage (Formulation per acre unless otherwise indicated)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
ALFALFA (con.)			Baits	Amount in bait formula				
Mormon cricket	Aldrin	—	EC or WP for wet bait; oil soln. for dry bait.	2 oz. aldrin	Prepare all baits according to directions in reference. Spread wet or dry bait ahead of advancing band of crickets at 10-20 lb. per acre.		Store bait where livestock cannot reach it. Do not pile it on ground. Keep livestock off air strips where planes are being loaded. Try not to spill bait; clean up any that is spilled.	FB 2081
	Chlordane	—	do.	½ lb. chlordane				
	Heptachlor	0.1	do.	4 oz. heptachlor				
	Sodium fluosilicate	—	Powder (for wet bait only)	4 lb.				
	Toxaphene	—	EC or WP for wet bait; oil soln. for dry bait.	1 lb. toxaphene				
Pea aphid	DDT	—	25% EC 10% D	3-4 qt. 20 lb.	As soon as buds appear.	—	Do not feed alfalfa treated with DDT to livestock or poultry.	Utah Cir. 135 and Ext. Cir. 221
	Malathion	8	EC (5 lb./gal.) 4% D	1 qt. 30 lb.	During bud stage.	7	—	
	Parathion	1	25% EC 1% D	1 pt. 30-35 lb.	do.	15	See Precautions.	
	TEPP	—	40% EC	1 pt.	During bud stage or in evening during bloom period to avoid killing bees.	3	do.	
Potato leafhopper	Methoxychlor	100	25% EC	1 qt.	When alfalfa is about half grown or earlier if insect becomes abundant.	7		L 229
				Per colony				
Red harvester ant	Carbon disulfide	—	Fumigant	4 fl. oz.	Pour into entrance hole of nest.		See Precautions.	FB 1668
	Chlordane	—	5% D	½ lb.	Spread thinly in continuous band 4-6 in. wide, in circle 5-6 ft. in diameter centering at nest entrance.		Do not dust vegetation that may be eaten by man or livestock. Do not broadcast dust.	
	Dieldrin	—	25% D	½ lb.				

LEGUME AND GRASS INSECTS (continued)

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Dosage (Formulation per acre unless otherwise indicated)	Application	Restrictions: Min. days from last application to harvest or feeding	Restrictions: Other	References
ALFALFA (con.)								
Spider mites	Sulfur	Safe	D	25 lb.	Before plants bloom, and again 10 days later if needed.			Utah Cir. 135
Spotted alfalfa aphid	Malathion	8	EC (5 lb./gal.) 5% D	1 pt. 15 lb.		7	—	
	Parathion	1	25% EC	1 pt.		15	See Precautions.	
Thrips. See Lygus bugs.								
Tortricid moth	Parathion	1	EC	½ lb. parathion	In May as soon as overwintering larvae start tying top leaves of plants.	15	See Precautions.	Utah Cir. 135
Yellow-striped armyworm. See Lygus bugs.								
CLOVER (seed crop)								
Clover seed weevil	DDT	—	5% D	20 lb.	When 20% of clover heads are withered and brown, in early morning or late evening when bees are inactive.		Do not feed treated clover to livestock.	Oreg. Cir. Inf. 485
Grasshoppers	. . . . Same as for Alfalfa							
Meadow spittlebug	do.							
GRASS (range and pasture)								
Grasshoppers	. . . . Same as for Alfalfa		EC, WP, D, or oil soln.				Do not feed forage treated with aldrin, chlordane, dieldrin, heptachlor, or toxaphene to dairy animals or animals being finished for slaughter and do not allow these animals to graze on treated vegetation.	FB 2064
Mormon cricket	. . . . Same as for Alfalfa							

LEGUME AND GRASS INSECTS (continued)

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Dosage (Formulation per acre unless otherwise indicated)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
GRASS (range and pasture) (con.)								
White-fringed beetles	DDT	—	EC, WP, D, or G	25 lb. DDT	Only in winter and early spring to surface of noncultivated land not used for grazing animals, under general direction of Federal or State white-fringed beetle personnel.			L 401
	Dieldrin	—	EC, WP, D, or G	3-5 lb. dieldrin				
PEANUTS								
Corn earworm	DDT	—	3% D	25 lb.			Do not feed peanut forage treated with DDT or toxaphene to livestock.	FB 2063
Fall armyworm	Toxaphene	—	20% D	10 lb.				
Potato leafhopper	DDT	—	1% D	First application 20 lb., second and third applications 25 lb.	First application about July 10, second 3 wk. later, and third 3 wk. after second.			
Southern corn rootworm	Aldrin	—	5% D 2% G In mixture with fertilizer.	40 lb. 100 lb. 2 lb. aldrin	To soil before planting. Broadcast dust with crop duster. Broadcast granules or insecticide-fertilizer mixture with fertilizer distributor, or apply to row with fertilizer side-dressing attachments. If broadcast cultivate immediately after application, working insecticide into top 3-4 in. of soil.			L 391
	Heptachlor	0.1	5% D 2.5% G In mixture with fertilizer.	40 lb. 80 lb. 2 lb. heptachlor				
Tobacco thrips	DDT	—	25% EC 3% D	3 pt. 10 lb.	As soon as injury appears and again 10 days later.		Do not feed treated forage to livestock.	FB 2063
Velvetbean caterpillar	DDT	—	3 or 5% D	20 lb.		—	Do not feed forage treated with DDT or toxaphene to livestock.	L 348
	Methoxychlor	100	5% D	20 lb.		7		
	Toxaphene	—	10% D	15 lb.		—		

LEGUME AND GRASS INSECTS (continued)

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Dosage (Formulation per acre unless otherwise indicated)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
PEANUTS (con.)								
White-fringed beetles	Aldrin	—	EC, WP, D, or G	Insecticide per acre Broadcast 3 lb. In drill row 3/4-1½ lb.	Broadcast on soil when preparing for planting and immediately work into upper 3 in. Or apply insecticide alone or mixed with a fertilizer in drill row at time of planting.			L 401
	Chlordane	0.3	EC, WP, D, or G	Broadcast 5 lb. In drill row 1-2 lb.				
	DDT	7	EC, WP, D, or G	Broadcast 10 lb. In drill row 2-3 lb.				
	Dieldrin	—	EC, WP, D, or G	Broadcast 1½ lb. In drill row ½-3/4 lb.				
	Heptachlor	0.1	EC, WP, D, or G	Broadcast 3 lb. In drill row 3/4-1½ lb.				
SOYBEANS								
Mexican bean beetle	Malathion	—	25% WP 5% D	4 lb. 35 lb.	To under surface of leaves.	7	—	FB 1624
	Methoxychlor	100	50% WP 5% D	3 lb. 35 lb.		7	—	
	Parathion	—	25% WP 2% D	2 lb. 35 lb.		15	See Precautions.	
Velvetbean caterpillar	. . . . Same as for Peanuts							
SWEETCLOVER								
Sweetclover weevil	Aldrin	—	EC (2 lb./gal.)	1 qt.	Early in spring to new stands to protect them from over-wintering adults.	—	Do not allow livestock to graze on sweetclover treated with aldrin or dieldrin until after first cutting.	Neb. E.C. 55-157
	Dieldrin	—	EC (1½ lb./gal.)	1½ pt.		—		
	Heptachlor	0.1	EC (2 lb./gal.)	1 qt.	To control newly emerged adults migrating from old stands in midsummer, apply heptachlor only.	10		
VETCH (seed crop)								
Vetch bruchid	DDT	—	3% D	25 lb.	As soon as first pods appear.	—	Do not feed treated vetch to livestock.	Oreg. Cir. Inf. 372

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Dosage (Formulation per acre unless otherwise indicated)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
CORN[1]								
Armyworm	DDT	—	25% EC	3 qt.	When larvae are young.		Do not feed treated corn as forage to livestock or use it for ensilage.	FB 1850
	Toxaphene	—	45% EC 60% EC	1½ qt. 1 qt.	do.			
Chinch bug								L 364
Border rows	Dieldrin	—	EC (1½ lb./gal.)	1½ pt.	To base of plants where bugs congregate. Coat or wet the bugs.		Do not feed plants treated with dieldrin or toxaphene to livestock.	
	Toxaphene	—	EC or WP 10% D 20% D	2 lb. toxaphene 20 lb. 10 lb.	do.			
Barrier strips	Dieldrin	—	EC (1½ lb./gal.)	3 pt.	Strip 4 rods wide, half along edge of small-grain field and half along edge of crop to be protected, and strip across each end; repeat 1 or 2 weeks later if needed.		Do not harvest grain for 7 days after it is treated with dieldrin. Do not feed straw from treated crop or treated corn to livestock.	
Corn earworm								PS 11, FB 1651
On dent corn, larvae in whorl, budworm damage	DDT	—	25% EC 1 gal. + light mineral oil ½ gal. to make 25 gal.	25 gal. spray	To entire plant before tasseling and silking.		Do not feed treated corn as forage to livestock or use it for ensilage.	
On seed corn, larvae in silks and ear tips	DDT	—	25% EC 3 gal. + light mineral oil 7 gal. to make 100 gal.	25 gal. spray	With high-clearance sprayer having 4 nozzles per row. Direct spray to ears. Make first application no later than 2 days after silks appear; repeat 3 days or 2 and 4 days later.		do.	

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[1] See also Sweet Corn under Vegetable, Bramble, and Strawberry Insects.

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Dosage (Formulation per acre unless otherwise indicated)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
CORN (con.)								
European corn borer on dent corn	DDT	—	EC or WP 5 or 10% D 5% G	1½ lb. DDT 40 or 20 lb. 15-20 lb.	When 3/4 of plants show feeding in whorl; and again 7-10 days later.		Do not feed DDT-treated corn as forage to dairy animals or animals being finished for slaughter or use it for ensilage.	Iowa Pamphlet 176, FB 2084
	Ryania	Exempt	40% D	30-40 lb.				
Fall armyworm	DDT or TDE	—	50% WP 5% D	2 lb. 40 lb.	When larvae are small.		Do not feed corn treated with these insecticides as forage to livestock or use it for ensilage.	FB 1990, PS 12
	Toxaphene	—	EC 5% D 20% D	1½-2 lb. toxaphene 40 lb. 10-15 lb.	do.			
On dent corn, larvae in whorl, budworm damage	DDT	—	25% EC 1 gal. + light mineral oil ½ gal. to make 25 gal.	25 gal. spray	To entire plant before tasseling and silking.			
Grasshoppers and Mormon cricket	. . . . Same as for Alfalfa						Do not feed corn sprayed or dusted with aldrin, chlordane, dieldrin, heptachlor, or toxaphene as forage to dairy animals or animals being finished for slaughter.	
Southern corn rootworm	Aldrin	—	EC (2 lb./gal.) 2.5% D Aldrin-fertilizer mixture	1 or 2 qt. 20 or 40 lb. ½ or 1 lb. aldrin	Minimum dosage to row or hills when planting; maximum dosage broadcast before planting and immediately work into top 3 or 4 in. of soil.			L 391
	Chlordane	—	45% EC 5% D Chlordane-fertilizer mixture	2 or 3 pt. 20 or 30 lb. 1 or 1½ lb. chlordane				
	Heptachlor	0.1	EC (2 lb./gal.) 2.5% D Heptachlor-fertilizer mixture	1 or 2 qt. 20 or 40 lb. ½ or 1 lb. heptachlor				

CORN, SORGHUM, AND SMALL-GRAIN INSECTS (continued)

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Dosage (Formulation per acre unless otherwise indicated)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
CORN (con.)								
Sugarcane beetle	Aldrin	—	EC (2 lb./gal.) 2% G 5% G	2 qt. 50 lb. 20 lb.	In 6-8 in. band on top of row at planting time or as soon as possible after corn comes up.		Do not apply after plants are 6 inches high.	
SORGHUM								
Chinch bug	. . . . Same as for Corn							
Corn earworm and corn leaf aphid on heads for seed	Aldrin	—	EC	72 mg. aldrin per bag	Streak inside of paper bags to be placed over sorghum heads.		Do not feed heads of sorghum that have been protected with aldrin-treated bags to milk animals, animals being finished for slaughter, or poultry.	
Fall armyworm	. . . . Same as for Corn							
Grasshoppers	. . . . Same as for Alfalfa							
Sorghum midge	DDT	—	5% D	25 lb.			Do not feed sorghum grain or forage treated with DDT to livestock.	FB 1566
	. . . . Also same as for Corn earworm and Corn leaf aphid on sorghum							
SMALL GRAINS								
Armyworm	. . . . Same as for Corn							
Chinch bug	. . . . Same as barriers for Chinch bug on corn							
Fall armyworm	. . . . Same as for Corn.							
Grasshoppers	. . . . Same as for Alfalfa.						Do not feed small grains treated with aldrin, chlordane, dieldrin, heptachlor, or toxaphene to dairy animals or animals being finished for slaughter.	FB 2064

CORN, SORGHUM, AND SMALL-GRAIN INSECTS (continued)

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Dosage (Formulation per acre unless otherwise indicated)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
SMALL GRAINS (con.)								
Greenbug on barley, oats, and wheat	Parathion	1	25% EC 1% D 2%	1 pt. 25 lb. 12½ lb.	When temperature is 50°F. or above.	14	See Precautions.	L 309
Mormon cricket	. . . . Same as for Alfalfa							
Red harvester ant	do.							
White-fringed beetles	. . . . Same as for Peanuts							

SUGAR-BEET AND SUGARCANE INSECTS

Restriction 1.--Do not apply DDT, chlordane, or toxaphene when foliage that is to be eaten by man or livestock is on the plants.

Restriction 2.--Parathion and TEPP are extremely poisonous. They should be applied only by a person familiar with the hazards who will assume full responsibility for safety and enforce the precautions prescribed by the manufacturers.

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Dosage (Formulation per acre unless otherwise indicated)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
SUGAR BEETS								
Aphids	Nicotine sulfate	—	40% soln.	1 pt. in S	On foliage.	—	—	FB 2060
	Parathion	—	1% D EC or WP	20-30 lb. ½ lb. parathion	do.	15	Restriction 2.	
	TEPP	—	1% D EC	20-30 lb. ½ lb. TEPP	do.	3	do.	
Armyworms	DDT	—	10% D	20-30 lb.	On foliage or in trap furrows.		Restriction 1.	
	Toxaphene	—	D	4-6 lb. toxaphene	do.		do.	
Blister beetles	DDT	—	10% D	20-30 lb.	On beetles.		do.	
	Toxaphene	—	D	4-6 lb. toxaphene			do.	
Cutworms	DDT	—	D, WP, or EC	2 lb. DDT	On soil surface and worked into top 2 in.		do.	
	Toxaphene	—	D, WP, or EC 3% B	2 lb. toxaphene 20 lb.	do. Scatter on soil surface late in afternoon.		do.	
Flea beetles	DDT	—	5% D	20 lb.	On foliage.		do.	
Grasshoppers	Toxaphene	—	B, WP, or EC	1½-2 lb. toxaphene	On foliage and soil.		do.	
Leaf miners	Parathion	—	1% D EC or WP	20-30 lb. ½ lb. parathion	On foliage.	15	Restriction 2.	
	Toxaphene	—	D WP or EC	2 lb. toxaphene 1½ lb. toxaphene	On foliage when insects appear.		Restriction 1.	
Lygus bugs	DDT	—	D, WP, or EC	½ lb. DDT	On foliage of young plants when insects appear.		do.	

SUGAR-BEET AND SUGARCANE INSECTS (continued)

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Dosage (Formulation per acre unless otherwise indicated)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
SUGAR BEETS (con.)								
Root maggots	Aldrin	—	WP	½ lb. aldrin/100 lb. seed	Mix dry with seed.		—	
			D, WP, or EC	3 lb. aldrin	To soil surface and work into top 3 in.		Apply before planting.	
	Heptachlor	—	D, WP, or EC	2 lb. heptachlor	do.		do.	
			WP	½ lb. heptachlor/100 lb. seed	Mix dry with seed.		—	
Webworms	Parathion	—	1% D EC or WP	20-30 lb. ¼ lb. parathion	On foliage when insects appear.	15	Restriction 2.	FB 2060
	Toxaphene	—	10% D EC or WP	20-30 lb. 1½ lb. toxaphene	do.	—	Restriction 1.	
White grubs	Chlordane	—	D, WP, or EC	10 lb. chlordane	To soil surface and work into top 3-4 in.		Apply before planting.	FB 1798
Wireworms	Chlordane	—	D, WP, or EC	5-8 lb. chlordane	To soil surface and work into top 6-9 in.		Apply before planting or after harvest.	FB 1866
	DDT	—	D, WP, or EC	10 lb. DDT	do.		do.	
	Ethylene dibromide	—	40% soln. (dilute 85% soln. with petroleum thinner 3:7 by vol.)	10 gal.	Inject 8 in. deep into fallow soil every 12 in.		Do not apply within 2 weeks before planting.	
SUGARCANE								
Sugarcane borer In Louisiana	Cryolite	—	D containing 85-90 % sodium fluoaluminate	8 or 10 lb. cryolite	Minimum dosage with ground machine and maximum with aircraft.			C 878
	Ryania	Exempt	40% D	8 or 10 lb.	For first generation apply 4 times at weekly intervals beginning with general hatching about April 15. For second generation in fields not already dusted, apply 4 times at weekly intervals beginning with general hatching about June 15.			
Wireworms	Chlordane	—	1% D	200 lb.	Apply on cane seed pieces in open furrow at time of planting in fall.			
Small soil arthropods	Chlordane	—	5% D	40 lb.				

VEGETABLE, BRAMBLE, AND STRAWBERRY INSECTS

Recommendations and tolerances given in this section apply only to crops to be used as human food and not as forage or for livestock feed. None of these recommendations apply to any crop that has been harvested or will be harvested within the next day.

The restrictions referred to by number in the table are as follows:

Restriction 1.--Do not apply DDT or toxaphene to spinach, brussel sprouts, kohlrabi, collard, kale, mustard, beet, swiss chard, rutabaga, or turnip when foliage that is to be eaten is on the plants. Do not apply DDT or toxaphene to foliage that is to be fed to livestock.

Restriction 2.--Do not use parathion, TEPP, sulfotepp, or demeton in the home garden. These insecticides are extremely poisonous and should be applied only by a trained operator who will enforce the precautions prescribed by the manufacturers and assume full responsibility for safety.

Restriction 3.--Do not apply DDT to lima beans for fresh market after the pods begin to form or to snap beans after the pods begin to form. Do not apply DDT to bean vines that are to be fed to livestock.

Restriction 4.--Do not apply chlordane to leafy vegetables past the seedling stage of growth, or to foliage that is to be fed to livestock.

Restriction 5.--Do not use lindane in fields to be planted later to potatoes or other root crops, as it may adversely affect their flavor.

Restriction 6.--Aerosols that are effective for use on plants usually contain the poison gas methyl chloride. Regardless of the insecticide in these aerosols they should be applied only by a trained operator who will enforce the precautions prescribed by the manufacturers and assume full responsibility for safety.

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Dosage (Formulation per acre unless otherwise indicated)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
ASPARAGUS								
Asparagus beetle	DDT	7	5% D 25% EC 50% WP	20-35 lb. 3 pt. 3 lb.	On foliage.		Do not use DDT during cutting season.	HG 46, FB 1646
	Rotenone	Exempt	0.75% D 5% powder	20-35 lb. 4 tbsp./gal. S	do.			
BEANS								
Aphids	Malathion	8	5% D 25% WP 50%	20-35 lb. 6 lb. 1½ pt.	On foliage.	3		HG 46
	Nicotine sulfate	2 (nicotine)	40% nicotine soln.	2 pt. in S	do.	—		
	Parathion	1	2% D	25-35 lb.	do.	Snap beans 21, others 15	Restriction 2.	
Bean leaf beetle	DDT	7	3-5% D 50% WP 25% EC	20-35 lb. 3 lb. 3 pt.	On foliage.		Restriction 3. Apply sparingly; heavy dosages may injure beans.	HG 46
	Rotenone	Exempt	0.75-1% 5% powder	20-35 lb. 2½ lb. in S	do.		—	

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Dosage (Formulation per acre unless otherwise indicated)	Application	Restrictions: Min. days from last application to harvest or feeding	Restrictions: Other	References
BEANS (con.)								
Corn earworm	DDT	7	3-5% D 50% WP 25% EC	20-35 lb. 3 lb. 3 pt.	On foliage.		Restriction 3. Apply sparingly; heavy dosages may injure beans.	HG 46
	Methoxychlor	14	5% D 30% WP 25% EC	20-35 lb. 3 lb. 3 pt.	do.	7		
Cutworms (in soil)	DDT	7	D, WP, or EC	2 lb. DDT	To soil surface before planting.		Do not apply on plants past seedling stage.	
	Toxaphene	7	D, WP, or EC	2 lb. toxaphene	do.		do.	
			3% B	40 lb.	Spread on soil (not plants) in late afternoon.		—	
Japanese beetle	DDT	7	Same as for Bean leaf beetle					
	Methoxychlor	14	Same as for Corn earworm					
Leafhoppers	DDT	7	Same as for Bean leaf beetle					
	Malathion	8	Same as for Aphids					
	Methoxychlor	14	Same as for Corn earworm					
	Parathion	1	Same as for Aphids					
Lima-bean pod borer	DDT	7	Same as for Bean leaf beetle					
Mexican bean beetle	Malathion	8	5% D 25% WP 50% EC	20-35 lb. 6 lb. 1½ pt.	On foliage.	3	—	FB 1624
	Methoxychlor	14	5% D 25% EC 50% WP	20-35 lb. 3 pt. 3 lb.	do.	7	—	
	Parathion	1	D, EC, WP	½ lb. parathion	do.	Snap beans 21, other 15	Restriction 2.	
	Rotenone	Exempt	0.75%-1% D 5% powder Extract	20-35 lb. 2½ lb. in S 1/8 lb. rotenone in S	do.	—	—	

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Dosage (Formulation per acre unless otherwise indicated)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
BEANS (con.)								
Root maggots	Aldrin Dieldrin Lindane	0 — 10	Slurry: 1/3 oz. 75% WP + 1½ oz. thiram 75% WP in 1 cup water	1 pt./100 lb. bean seed	Mix with seed and dry at least 1 hour within 30 days of planting.			L 370
Spider mites	Aramite	Snap beans 1 and others 0	3% D 15% WP	20-35 lb. 1½ lb.	On foliage.	15	Do not apply Aramite to lima beans while pods are on plants if they are for fresh market.	HG 46
	Malathion	8	Same as for Mexican bean beetle					
	Parathion	1	do.					
Cucumber beetles	DDT	7	Same as for Bean leaf beetle					
	Rotenone	Exempt	Same as for Mexican bean beetle					
Stink bugs	DDT	7	Same as for Bean leaf beetle					
	Sabadilla	Exempt	20% D	20-35 lb.	On foliage.			HG 46
Western bean cutworm	DDT	7	5% D	20-35 lb.	On foliage at 2-day intervals after young worms are found.		Restriction 3.	Idaho Ext. Bul. 233
Wireworms	Chlordane	0.3	D, WP, or EC	4-8 lb. chlordane	To soil surface every 2-5 years and work into top 6-9 in.		Apply either before planting or after harvest. DDT recommended only in irrigated lands in West.	FB 1866
	DDT	7	D, WP, or EC	10 lb. DDT				
	Ethylene dibromide	Lima beans 5 (inorganic bromides)	40% soln. (dilute 85% soln. with petroleum thinner 1:7 by vol.)	10 gal.	Inject 8 in. into fallow soil every 12 in.		Do not apply within 2 weeks before planting.	

VEGETABLE, BRAMBLE, AND STRAWBERRY INSECTS (continued)

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Dosage (Formulation per acre unless otherwise indicated)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
BEETS (table)								
Beet webworm	DDT	7	5% D 50% WP 25% EC	20-30 lb. 3 lb. 3 pt.	On foliage.		Restriction 1.	HG 46
	Pyrethrum	Exempt	0.2% D EC	20-30 lb. 1/40 lb. pyrethrins	do.		—	
	Toxaphene	—	10% D EC or WP	20-30 lb. 1½ lb. toxaphene	do.		Restriction 1.	
Blister beetles	DDT	7	5% D 50% WP 25% EC	20-30 lb. 3 lb. 3 pt.	On beetles.	—	Restriction 1.	
	Methoxychlor	14	5% D 50% WP 25% EC	20-30 lb. 3 lb. 3 pt.	do.	7	—	
Cutworms	DDT	7	D, WP, or EC	2 lb. DDT	To soil surface before planting.		Restriction 1.	
	Toxaphene	—	D, WP, or EC 3% B	2 lb. toxaphene 40 lb.	do.		do.	
Flea beetle (adults)	DDT	7	5% D 50% WP 25% EC	20-30 lb. 3 lb. 3 pt.	On foliage.	—	Restriction 1.	
	Methoxychlor	14	5% D 50% WP 25% EC	20-30 lb. 3 lb. 3 pt.	do.	7	—	
	Rotenone	Exempt	0.75-1% D 5% powder	20-30 lb. 2½ lb. in S	do	—	—	
Wireworms	Chlordane	0.3	D, WP, or EC	4-8 lb. chlordane	To soil surface every 2-5 years and work into top 6-9 in.		Apply either before planting or after harvest. DDT recommended only in irrigated lands in West.	FB 1866
	DDT	7	D, WP, or EC	10 lb. DDT				
	Ethylene dibromide	—	40% soln. (dilute 85% soln. with petroleum thinner 3:7 by vol.)	10 gal.	Inject 8 in. into fallow soil every 12 in.		Do not apply within 2 weeks before planting.	

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Dosage (Formulation per acre unless otherwise indicated)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
BLACKBERRY								
Aphids	Malathion	—	5% D 25% WP 50% EC	20-35 lb. 6 lb. 1½ pt.	On foliage.		Do not apply malathion while fruit is on plants.	HG 46
	Nicotine sulfate	2 (nicotine)	40% nicotine soln.	2 pt. in S	do.		—	
Japanese beetle (adults) and rose chafer	DDT	7	5% DDT 50% WP 25% EC	20-35 lb. 3 lb. 3 pt.	On foliage.	—	Do not apply DDT while fruit is on plants.	
	Methoxychlor	14	5% D 50% WP 25% EC	20-35 lb. 3 lb. 3 pt.	do.	7	—	
Orange tortrix	Cryolite	7 (fluorine)	50-90% D	20-35 lb. as D 15 lb. cryolite in S	To foliage in spring when plants begin to grow.		Do not apply while fruit is on plants.	
	TDE	7	5% D 50% WP	20-35 lb. 6 lb.	do.		do.	
Raspberry cane borer, red-necked cane borer	Rotenone	Exempt	0.75% D 5% powder	20-35 lb. 2½ lb. in S	On foliage just before plants begin to bloom; repeat in about 2 weeks.			
Raspberry fruitworm	Rotenone	Exempt	0.75% D	20-35 lb.	On foliage 7 days after first blossoms; repeat in 10 and 20 days.			
Rose scale	Malathion	—	5% D 25% WP 50% EC	20-35 lb. 6 lb. 1½ pt.	On foliage after harvest.		Do not apply malathion while fruit is on plants.	
	White oil	Exempt	EC	½ cup/gal. water	On dormant plants.		—	
Stink bugs	DDT	7	5% DDT 50% WP 25% EC	20-35 lb. 3 lb. 3 pt.	On foliage.		Do not apply DDT while fruit is on plants.	
	Sabadilla	Exempt	20% D	20-35 lb.	do.		—	

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Dosage (Formulation per acre unless otherwise indicated)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
BROCCOLI								
Cabbage aphid	Malathion	8	5% D 25% WP 50% EC	20-35 lb. 6 lb. 1½ pt.	On foliage when aphids first appear; repeat weekly as long as needed.	3	—	FB 1957
	Nicotine sulfate	2 (nicotine)	40% nicotine soln.	2 pt. in S	do.	—	—	
	Parathion	1	2% D EC or WP	20-35 lb. ½ lb. parathion	On foliage.	21	Restriction 2.	
	Demeton	0.75	EC	¼ to ½ lb. demeton	do.	21	Restriction 2.	
Cabbage looper and other caterpillars	DDT	7	5% D 50% WP 25% EC	25 lb. 2½ lb. 2½ qt.	On foliage every 7-10 days. On summer or fall plantings in South begin as soon as true leaves appear. On other plantings begin when insects appear.		Do not apply DDT or toxaphene after heads begin to form.	FB 1957
	Toxaphene	7	10-15% D 40% WP 63% EC	25 lb. 6-9 lb. 3-5 pt.				
	Rotenone	Exempt	1% D 5% EC 5% powder	25 lb. 2 qt. 5 lb. in S				
Cutworms (soil)	Toxaphene	7	D, WP, or EC 3% B	2 lb. toxaphene 40 lb.	Apply to soil surface before planting. Spread on soil, not plants, in late afternoon.		Do not apply D or S on plants past seedling stage.	
Harlequin bug and stink bugs	Sabadilla	Exempt	10-20% D	25 lb.	On foliage.			HG 44
Root maggots	Chlordane	0.3	40-50% WP 72-75% EC 5% D	4 lb. 1 qt. 30 lb.	To soil at base of plants when leaves first appear; repeat shortly after thinning or transplanting.		Restriction 4	FB 1957, HG 44
			Drench: 1½ lb. 40% WP or ½ pt. 72% EC/100 gal.	3/4 cup/plant	On soil where plant is set.			

VEGETABLE, BRAMBLE, AND STRAWBERRY INSECTS (continued)

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Dosage (Formulation per acre unless otherwise indicated)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
BRUSSELS SPROUTS								
Cabbage aphid	Malathion	8	5% D 25% WP 50% EC	20-35 lb. 6 lb. 1½ pt.	On foliage when aphids first appear; repeat weekly as long as needed.	7		HG 44
	Nicotine sulfate	2 (nicotine)	40% nicotine soln.	2 pt. in S	do.	—		
	Parathion	1	2% D EC or WP	20-30 lb. ½ lb. parathion	On foliage.	21	Restriction 2.	
	Demeton	0.75	EC	¼-½ lb. demeton	do.	21	do.	
Cabbage looper and other caterpillars	DDT	7	. . . . Same as for Broccoli				Do not apply DDT or toxaphene on plants past seedling stage.	HG 44
	Toxaphene	7	do.					
	Rotenone	Exempt	do.					
Cutworms (soil)	Toxaphene	7	do.				Do not apply D or S on plants past seedling stage.	
Root maggots	Chlordane	0.3	do.				Restriction 4.	
CABBAGE								
Aphids	Malathion	8	5% D 25% WP 50% EC	20-35 lb. 6 lb. 1½ pt.	On foliage when aphids first appear; repeat weekly as long as needed.	7		HG 46
	Nicotine sulfate	2 (nicotine)	40% nicotine soln.	2 pt. in S	do.			
	Parathion	1	2% D EC or WP	20-35 lb. ½ lb. parathion	On foliage.	21	Restriction 2.	
	Demeton	0.75	EC	¼-½ lb. demeton	do.	21	do.	

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Dosage (Formulation per acre unless otherwise indicated)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
CABBAGE (con.)								
Caterpillars	DDT	7	5% D 50% WP 25% EC	25 lb. 2½ lb. 2½ qt.	On foliage every 7-10 days. On summer or fall plantings in South begin as soon as true leaves appear. On other plantings begin when insects appear.		Do not apply DDT or toxaphene after heads begin to form.	HG 44
	Toxaphene	7	10-15% D 40% WP 63% EC	25 lb. 6-9 lb. 3-5 pt.				
	Rotenone	Exempt	1% D 5% EC 5% powder	25 lb. 2 qt. 5 lb. in S				
Cutworms	Toxaphene	7	D, WP, or EC	2 lb. toxaphene	To soil surface before planting.		Do not apply D or S after heads begin to form.	
			3% B	40 lb.	Spread on soil (not plants) in late afternoon.			
Flea beetles	DDT	7	5% D 50% WP 25% EC	25 lb. 2½ lb. 2½ qt.	On foliage.	—	Do not apply after heads begin to form.	
	Methoxychlor	14	5% D 50% WP 25% EC	20-30 lb. 3 lb. 3 pt.	do.	7	—	
	Rotenone	Exempt	0.75-1% D 5% powder	20-30 lb. 2½ lb. in S	do.	—	—	
Harlequin bug and stink bugs	DDT	7	5% D 50% WP 25% EC	25 lb. 2½ lb. 2½ qt.	On foliage.		Do not apply DDT after heads begin to form.	
	Sabadilla	Exempt	10-20% D	25 lb.	do.		—	
Mole crickets	Chlordane	0.3	D, WP, or EC	1-2 lb. chlordane	On soil of infested field.		Restriction 4.	
			3% B	40 lb.	Scatter on soil (not plants) in late afternoon.			
			Drench: 4 oz. 50% WP/100 gal.	100 gal./1000 sq. ft.	To surface of seedbed before planting.			

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Dosage (Formulation per acre unless otherwise indicated)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
CABBAGE (con.)								
Root maggots	Chlordane	0.3	40-50% WP 72-75% EC 5% D	4 lb. 1 qt. 30 lb.	To soil at base of plants when leaves first appear; repeat shortly after transplanting or thinning.		Restriction 4.	HG 44
			Drench: 1½ lb. 50% WP or ½ pt. 75% EC/100 gal.	3/4 cup/plant	On soil where each transplant is set.		do.	
Vegetable weevil	DDT	7	5% D 50% WP 25% EC	25 lb. 2½ lb. 2½ qt.	On foliage.		Do not apply after heads begin to form.	
	Rotenone	Exempt	1% D 5% EC 5% powder	25 lb. 2 qt. 5 lb. in S	do.		do.	
White-fringed beetle grubs	DDT	7	D, WP, or EC	¼ lb. DDT/1000 sq. ft.	To soil surface before planting; work into top 3 in.		Do not apply after heads begin to form.	
	Chlordane	0.3	D, WP, or EC	1/8 lb. chlordane/ 1000 sq. ft.	do.		Do not apply to plants past seedling stage.	
Wireworms	Chlordane	0.3	D, WP, or EC	4-8 lb. chlordane	To soil surface and work into top 6-9 in.		Apply either before planting or after harvest. DDT recommended only in irrigated lands in West.	FB 1866
	DDT	7	D, WP, or EC	10 lb. DDT	do.			
CANTALOUP. See Melons.								
CARROT								
Carrot rust fly	Chlordane	0.3	D, EC, or WP	5 lb. chlordane	To soil surface and work into top 6 in. before planting.		Do not apply to plants past seedling stage.	HG 46

VEGETABLE, BRAMBLE, AND STRAWBERRY INSECTS (continued)

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Dosage (Formulation per acre unless otherwise indicated)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
CARROT (con.)								
Leafhoppers	DDT	7	5% D 50% WP 25% EC	20-30 lb. 3 lb. 3 pt.	On foliage.	—	Do not use DDT-treated tops for food or feed.	HG 46
	Methoxychlor	14	5% D 50% WP 25% EC	20-30 lb. 3 lb. 3 pt.	do.	7	—	
Vegetable weevil	DDT	7	5% D 50% WP 25% EC	20-30 lb. 3 lb. 3 pt.	On foliage.		Do not use DDT-treated foliage for food or feed.	
	Rotenone	Exempt	1% D 5% EC 5% powder	25 lb. 2 qt. 5 lb. in S	do.		—	
Wireworms	Chlordane	0.3	D, WP, or EC	5-8 lb. chlordane	To soil surface and work into top 6-9 in.		Apply either before planting or after harvest.	FB 1866
	DDT	7	D, WP, or EC	10 lb. DDT				
	Ethylene dibromide	75 (inorganic bromides)	40% soln. (dilute 85% soln. with petroleum thinner 1:7 by vol.)	10 gal.	Inject 8 in. deep into fallow soil every 12 in.		Do not apply within 2 weeks before planting.	
CAULIFLOWER								
Aphids	Malathion	8	. . . . Same as for Cabbage			7	—	FB 1957
	Nicotine sulfate	2 (nicotine)		do.		—	—	
	Parathion	1		do.		21	Restriction 2.	
	Demeton	0.75		do.		21	do.	
Caterpillars	DDT	7		do.			Do not apply DDT or toxaphene after the curd begins to form.	FB 1957
	Toxaphene	7		do.				
	Rotenone	Exempt		do.				
Cutworms	Toxaphene	7		do.			do.	

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Dosage (Formulation per acre unless otherwise indicated)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
CAULIFLOWER (con.)								
Flea beetle	DDT	7		. . . . Same as for Cabbage		—	Do not apply DDT after curd begins to form.	HG 46
	Rotenone	Exempt		do.		—		
	Methoxychlor	14		do.		7		
Harlequin bug and stink bugs	DDT	7		do.			Do not apply DDT after curd begins to form.	
	Rotenone	Exempt		do.				
	Sabadilla	Exempt		do.				
Mole crickets	Chlordane	0.3		do.			Restriction 4.	L 237
Root maggots	Chlordane	0.3		do.			do.	HG 44 and 46
Vegetable weevil	DDT	7		do.			Do not apply DDT after curd begins to form.	
	Rotenone	Exempt		do.				
White-fringed beetle grubs	DDT	7		do.			Do not apply after curd begins to form.	
	Chlordane	0.3		do.			Restriction 4.	
Wireworms	Chlordane	0.3		. . . . Same as for Beets.			do.	FB 1866
	Ethylene dibromide	10 (inorganic bromides)		do.			Do not apply within 2 weeks before planting.	
CELERY								
Aphids	Malathion	8		. . . . Same as for Cabbage		7	—	
	Nicotine sulfate	2 (nicotine)		do.		—	—	
	Parathion	1		do.		21	Restriction 2.	

VEGETABLE, BRAMBLE, AND STRAWBERRY INSECTS (continued)

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Dosage (Formulation per acre unless otherwise indicated)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
CELERY (con.)								
Celery leaf tier	Pyrethrum	Exempt	0.2% D EC	20-30 lb. 1/40 lb. pyrethrum	2 applications ½ hour apart.	—	—	HG 46
	DDT	7	5% D 50% WP 25% EC	20-30 lb. 2½ lb. 2½ qt.	On foliage.	30	Do not apply after bunch begins to form or after stalk is half grown, whichever is earlier	
Cutworms (soil)	DDT	7	D, WP, or EC	2 lb. DDT	To soil surface.		Do not apply on plants past the seedling stage.	
	Toxaphene	7	D, WP, or EC	2 lb. toxaphene	do.		do.	
			3% B	40 lb.	Spread on soil (not plants) in late afternoon.		—	
Lygus bugs	DDT	7	5% D 50% WP 25% EC	20-30 lb. 2½ lb. 2½ qt.	On foliage.	30	Do not apply after bunch begins to form or after stalk is half grown, whichever is earlier	
	Pyrethrum	Exempt	0.2% EC	20-30 lb. 1/40 lb. pyrethrum	do.	—	—	
Spider mites	Aramite	1	3% D	20-30 lb.	On foliage.	15		HG 46
	Malathion	8	5% D 25% WP 50% EC	20-30 lb. 6 lb. 1½ pt.	do.	7		
	Parathion	1	2% D EC or WP	20-30 lb. ½ lb. parathion	do.	21	Restriction 2.	
CHARD. See Swiss chard.								
COLLARDS								
Aphids	Nicotine sulfate	2 (nicotine)	. . . . Same as for Cabbage					HG 44
	Parathion	1	do.			21	Restriction 2.	

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Dosage (Formulation per acre unless otherwise indicated)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
COLLARDS (con.)								
Cabbage looper and other caterpillars	DDT	7	. . . .	Same as for Cabbage	. . . .		Restriction 1.	HG 44
	Rotenone	Exempt		do.			—	
	Toxaphene	—		do.			Restriction 1.	
Cutworms (soil)	DDT	7		do.			do.	HG 29
	Toxaphene	—		do.			do.	
Flea beetles	DDT	7		do.		—	do.	HG 46
	Rotenone	Exempt		do.		—	—	
	Methoxychlor	14		do.		7	—	
Harlequin bug and stink bugs	DDT	7		do.			Restriction 1.	
	Rotenone	Exempt		do.			—	
	Sabadilla	Exempt		do.			—	
Mole crickets	Chlordane	0.3		do.			Restriction 4.	L 237
Root maggots	Chlordane	0.3		do.			do.	HG 44
Vegetable weevil	DDT	7		do.			Restriction 1.	
	Rotenone	Exempt		do.			—	
Wireworms	Chlordane	0.3		do.			Apply either before planting or after harvest.	
CORN. See Sweet corn.								
COWPEA. See Peas, blackeye.								

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Dosage (Formulation per acre unless otherwise indicated)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
CUCUMBER, FIELD								
Aphids	Malathion	8	5% D 25% WP 50% EC	20-40 lb. 6 lb. 1½ pt.	On foliage.	3		HG 46
	Nicotine sulfate	2 (nicotine)	40% nicotine soln.	2 pt. in S	do.	—		
	Parathion	1	1% D EC or WP	20-40 lb. ¼ lb. parathion	do.	15	Restriction 2.	
	TEPP	0	1% D EC	20-40 lb. ¼ lb. TEPP	do.	3	do.	
Cucumber beetles	Cryolite	7 (fluorine)	50-90% D	20-40 lb. as D 6 lb. cryolite in S	do.	—	Remove excess residue by washing or brushing.	HG 46
	Methoxychlor	14	5% D 50% WP	20-40 lb. 3 lb.	do.	7	—	
	Rotenone	Exempt	1% D 4% powder	20-40 lb. 4 lb. in S	do.	—	—	
Pickleworm	Cryolite	7 (fluorine)	50-90% D	20-40 lb. as D 8 lb. cryolite in S	On foliage when worms appear in blossoms; repeat.	—	Remove excess residue by washing or brushing.	
	Lindane	10	1% D 25% WP	20-40 lb. 1 lb.	do.	1	Restriction 5.	
	Rotenone	Exempt	1% D	20-40 lb.	do.	—	Only partly effective	
	Sabadilla	Exempt	20% D	20-40 lb.	do.	—	do.	
Spider mites	Aramite	1	3% D 15% WP	20-35 lb. 1½ lb.	On foliage.	15		HG 46
	Malathion	8	5% D 25% WP 50% EC	20-35 lb. 6 lb. 1½ pt.	do.	3		
	Parathion	1	2% D	20-35 lb.	do.	15	Restriction 2.	

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Dosage (Formulation per acre unless otherwise indicated)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
CUCUMBER, GREENHOUSE								
Aphids	Nicotine	2 (nicotine)	40% nicotine soln.	2 tsp./gal. S	On foliage.	—	—	
	Malathion	8	WP or EC	1 lb. malathion/100 gal.	do.	3	—	
			10% aerosol	1 lb./50,000 cu. ft.	In closed greenhouse in air above plants. Temperature should be 70-85°F. and ventilators closed for at least 2 hours.	3	Should be used only by a trained operator. Restriction 6.	
	Parathion	1	10% aerosol	do.	do.	15	Restrictions 2 and 6.	
	Sulfotepp	0	5% aerosol	do.	do.	15	do.	
	TEPP	0	5% aerosol	do.	do.	3	do.	
Armyworms, cabbage looper, cutworms, earwigs, and thrips	DDT	7	3% D 50% WP	—	On foliage.	—	Do not use DDT on cucumber after fruit begins to form.	
	Malathion	8	. . . . Same as for Aphids					
	Parathion	1	do.					
Cucumber beetles	DDT	7	3% D	—	On foliage.	—	Do not use DDT on cucumber after fruit begins to form.	
	Parathion	1	10% aerosol	1 lb./50,000 cu. ft.	Same as for Aphids.	15	Restrictions 2 and 6.	
	Rotenone	Exempt	1% D	—	On foliage.	—	—	
Garden centipede	Lindane	10	Drench: 5 oz. 25% WP/50 gal.	50 gal./1,000 sq. ft.	Spray on soil and water it in. For newly set plants, put 1 pt. around base of each plant.		Do not use lindane for this purpose except in greenhouse. Restriction 5.	
Greenhouse whitefly and spider mites	Malathion	8	. . . . Same as for Aphids					
	Parathion	1	do.					
	TEPP	0	do.					

VEGETABLE, BRAMBLE, AND STRAWBERRY INSECTS (continued)

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Dosage (Formulation per acre unless otherwise indicated)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
CUCUMBER, GREENHOUSE (con.)								
Mealybug	Malathion	8			Same as for Aphids			
	Parathion	1			do.			
	Sulfotepp	0			do.			
	TEPP	0			do.			
Mushroom mite	Parathion	1			do.			
	Sulfotepp	0			do.			
	TEPP	0			do.			
Spider mites	Same as for Greenhouse whitefly							
Thrips	Same as for Armyworms.							
EGGPLANT								
Colorado potato beetle	DDT	7	5% D 50% WP 25% EC	20-30 lb. 3 lb. 3 pt.	On foliage.	5		HG 46
	Rotenone	Exempt	0.75% D 5% powder	20-30 lb. 2½ lb. in S	do.	—		
Cutworms	DDT	7	D, WP, or EC	2 lb. DDT	On soil surface.		Do not apply on plants past seedling stage.	
	Toxaphene	7	D, WP, or EC	2 lb. toxaphene	do.		do.	
			3% B	40 lb.	Scatter on soil (not plants) late in afternoon.		—	
Eggplant lace bug	Malathion	8	5% D 25% WP 50% EC	20-30 lb. 6 lb. 1½ pt.	On foliage.	3		

VEGETABLE, BRAMBLE, AND STRAWBERRY INSECTS (continued)

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Dosage (Formulation per acre unless otherwise indicated)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
EGGPLANT (con.)								
Flea beetles	DDT	7	5% D 50% WP 25% EC	20-30 lb. 3 lb. 3 pt.	On foliage.	5	Restriction 1.	HG 46
	Methoxychlor	14	5% D 50% WP 25% EC	20-30 lb. 3 lb. 3 pt.	do.	7	—	
	Rotenone	Exempt	0.75-1% D 5% powder	20-30 lb. 2½ lb. in S	do.	—	—	
Hornworms	TDE	7	10% D 50% WP 25% EC	20-30 lb. 4 lb. 1 gal.	do.	3		
Spider mites	Malathion	8	5% D 25% WP 50% EC	20-30 lb. 6 lb. 1½ pt.	do.	3		
HOPS								
Aphids and spider mites	Parathion	1	1% D	30-40 lb.	On foliage.	15	Restriction 2.	
KALE								
Aphids	Malathion	8	5% D 25% WP 50% EC	20-35 lb. 6 lb. 1½ pt.	On foliage when aphids first appear; repeat weekly as long as needed.	7		HG 46
	Nicotine sulfate	2 (nicotine)	40% nicotine soln.	2 pt. in S	do.	—		
	Parathion	1	2% D EC or WP	20-35 lb. ½ lb. parathion	On foliage.	21	Restriction 2.	
Cabbage looper and other caterpillars	DDT	7	5% D 50% WP 25% EC	25 lb. 2½ lb. 2½ qt.	On foliage every 7-10 days as needed. Begin on summer or fall plantings in South as soon as true leaves appear, and on other plantings when insects appear.		Restriction 1.	HG 44
	Rotenone	Exempt	1% D 5% EC 5% powder	25 lb. 2 qt. 5 lb. in S.	do.		—	

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Dosage (Formulation per acre unless otherwise indicated)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
KALE (con.)								
Cutworms (soil)	DDT	7	D, WP, or EC	2 lb. DDT	To soil surface preferably before planting.		Restriction 1.	HG 44
	Toxaphene	—	D, WP, or EC	2 lb. toxaphene	do.		do.	
			3% B	40 lb.	Spread on soil (not plants) in late afternoon.		—	
Flea beetles	DDT	7	5% D	25 lb.	On foliage.	—	Restriction 1.	
			50% WP	2½ lb.				
			25% EC	2½ qt.				
	Methoxychlor	14	5% D	25 lb.	do.	7	—	
			50% WP	3 lb.				
			25% EC	3 pt.				
	Rotenone	Exempt	1% D	25 lb.	do.	—	—	
			5% EC	2 qt.				
			5% powder	5 lb. in S				
Harlequin bug and stink bugs	DDT	7	5% D	25 lb.	do.		Restriction 1.	
			50% WP	2½ lb.				
			25% EC	2½ qt.				
	Rotenone	Exempt	1% D	25 lb.	do.		—	
			5% EC	2 qt.				
			5% powder	5 lb. in S				
	Sabadilla	Exempt	10-20% D	25 lb.	do.		—	
Mole crickets	Chlordane	0.3	D, WP, or EC	1-2 lb. chlordane	On soil.		Restriction 4.	
			3% B	40 lb.	Scatter on soil.			
			Drench: 4 oz. 50% WP/100 gal.	100 gal./1,000 sq. ft.	To soil surface in seedbed preferably before planting.			
Root maggots	Chlordane	0.3	40-50% WP	4 lb.	To soil at base of plants when leaves first appear; repeat shortly after transplanting or thinning.		Restriction 4.	
			72-75% EC	1 qt.				
			5% D	30 lb.				
			Drench: 1½ lb. 40-50% WP or ½ pt. 72-75% EC	3/4 cup/plant	On soil where each transplant is set.			

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Dosage (Formulation per acre unless otherwise indicated)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
KALE (con.)								
Vegetable weevil	DDT	7	5% D 50% WP 25% EC	25 lb. 2½ lb. 2½ qt.	On foliage.		Restriction 1.	HG 44
	Rotenone	Exempt	1% D 5% EC 5% powder	25 lb. 2 qt. 5 lb. in S	do.		—	
White-fringed beetle grubs	Chlordane	0.3	D, WP, or EC	1/8 lb. chlordane/ 1,000 sq. ft.	To soil surface before planting. Work into top 3 in.		Restriction 4.	
	DDT	7	D, WP, or EC	½ lb. DDT/1,000 sq. ft.	do.		Restriction 1.	
Wireworms	Chlordane	0.3	D, WP, or EC	4-8 lb. chlordane	To soil surface and work into top 6-9 in. before planting or after harvest.		Restriction 4.	
KOHLRABI								
Aphids	Nicotine sulfate	2 (nicotine)	40% nicotine soln.	2 pt. in S	On foliage when aphids first appear; repeat weekly as long as needed.	—	—	
	Parathion	1	2% D EC or WP	20-35 lb. ½ lb. parathion	On foliage.	21	Restriction 2.	
Caterpillars	DDT	7	5% D 50% WP 25% EC	25 lb. 2½ lb. 2½ qt.	do.		Restriction 1	HG 44 and 46
	Rotenone	Exempt	1% D 5% EC 5% powder	25 lb. 2 qt. 5 lb. in S	do.		—	
	Toxaphene	7	10-15% D 40% WP 63% EC	25 lb. 6-9 lb. 3-5 pt.	do.		—	
Cutworms (soil)	DDT	7	. . . . .Same as for Kale				Restriction 1.	
	Toxaphene	7		do.			do.	
Flea beetles	DDT	7		do.		—	Restriction 1.	
	Methoxychlor	14		do.		7	—	
	Rotenone	Exempt		do.		—	—	
Root maggots	Chlordane	0.3		do.			Restriction 4.	

VEGETABLE, BRAMBLE, AND STRAWBERRY INSECTS (continued)

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Dosage (Formulation per acre unless otherwise indicated)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
LETTUCE, FIELD								
Caterpillars	DDT	7	5% D 25% EC 50% WP	20-30 lb. 3 pt. 3 lb.	On foliage.	30	Do not apply to head lettuce after heads begin to form or to leaf lettuce after seedling stage of growth.	HG 46, Ariz. Ext. Cir. 219
	Dieldrin	—	D, WP, or EC	½ lb. dieldrin	do.	30	do.	
	Toxaphene	7	D, WP, or EC	3-4½ lb. toxaphene	do.	30	do.	
	Rotenone	Exempt	1% D 5% powder	20-30 lb. 4½ lb. in S	do.	—	—	
Leafhoppers	DDT	7	. . . .	Same as for Kale	. . . .	30	Do not apply DDT to head lettuce after heads begin to form or to leaf lettuce after seedling stage of growth.	HG 46
	Malathion	8		do.		7		
	Methoxychlor	14		do.		7		
Mole crickets	Chlordane	0.3		do.		30	Restriction 4.	L 237
Wireworms	Chlordane	0.3		do.			Apply either before planting or after harvest.	FB 1866
LETTUCE, GREENHOUSE								
Aphids	Malathion	8	WP or EC	1 lb. malathion/ 100 gal.	On foliage.	7	—	
			10% aerosol	1 lb./50,000 cu. ft.	Apply aerosols in closed greenhouse in air above plants. Temperature should be 70-85°F. and ventilators closed for at least 2 hours.	7	Restriction 6.	
	Parathion	1	10% aerosol	do.		21	Restriction 2 and 6.	
	Sulfotepp	0	5% aerosol	do.		21	do.	
	TEPP	0	5% aerosol	do.		3	do.	
	Nicotine sulfate	2 (nicotine)	40% nicotine soln.	2 tsp./gal.	On foliage.	—	—	

VEGETABLE, BRAMBLE, AND STRAWBERRY INSECTS (continued)

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Dosage (Formulation per acre unless otherwise indicated)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
LETTUCE, GREENHOUSE (con.)								
Armyworms, cabbage looper, and cutworms	DDT	7	3% D	—	On foliage.	—	Do not apply to head lettuce after heads begin to form or to leaf lettuce after seedling stage of growth.	
	Malathion	8	WP or EC	1 lb. malathion	do.	7	—	
			10% aerosol	1 lb./50,000 cu. ft.	Same as for Aphids.	7	Restriction 6.	
	Parathion	1	10%	1 lb./50,000 cu. ft.	do.	21	Restriction 2 and 6.	
Greenhouse whitefly	Malathion	8	WP or EC	1 lb. malathion	On foliage.	7	—	
			10% aerosol	1 lb./50,000 cu. ft.	Same as for Aphids.	7	Restriction 6.	
	Parathion	1	10% aerosol	do.	do.	21	Restriction 2 and 6.	
	TEPP	0	5% aerosol	do.	do.	3	do.	
Sowbugs	DDT	7	3% D	—	On soil and in hiding places.	—	Do not apply to head lettuce after heads begin to form or to leaf lettuce after seedling stage of growth.	
	Parathion	1	10% aerosol	1 lb./50,000 cu. ft.	Same as for Aphids.	21	Restriction 2 and 6.	
LOGANBERRY								
Aphids	Malathion	—	5% D	20-35 lb.	On foliage.		Do not apply while fruit is on plants.	HG 46
			25% WP	6 lb.				
			50% EC	1½ pt.				
	Nicotine sulfate	2 (nicotine)	40% nicotine soln.	2 pt. in S	do.		—	
Japanese beetle adults and rose chafer	DDT	7	5% DDT	20-35 lb.	do.	—	Do not apply while fruit is on plants.	
			50% WP	3 lb.				
			25% EC	3 pt.				
	Methoxychlor	14	5% D	20-35 lb.	do.	7	—	
			50% WP	3 lb.				
			25% EC	3 pt.				

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Dosage (Formulation per acre unless otherwise indicated)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
LOGANBERRY (con.)								
Orange tortrix	Cryolite	7 (fluorine)	50-90% D	20-35 lb. as D 15 lb. cryolite in S	On foliage in spring when plants begin to grow.		Do not apply while fruit is on plants.	HG 46
	TDE	7	5% D 50% WP	20-35 lb. 6 lb.	do.		do.	
Raspberry cane borer	Rotenone	Exempt	0.75% D 5% powder	20-35 lb. 2½ lb. in S	On foliage just before plants begin to bloom; repeat in 2 weeks.			
Raspberry fruitworm	Rotenone	Exempt	0.75% D 5% powder	20-35 lb. 2½ lb. in S	On foliage 7 days after first blossoms; repeat in 10 and 20 days.			
Rose chafer. See Japanese beetle.								
Rose scale	Malathion	—	5% D 25% WP 50% EC	20-35 lb. 6 lb. 1½ pt.	On foliage after harvest.		Do not apply while fruit is on plants.	
	White oil	Exempt	EC	½ cup/gal. water	On dormant plants.		—	
Stink bugs	DDT	7	5% DDT 50% WP 25% EC	20-35 lb. 3 lb. 3 pt.	On foliage.		Do not apply while fruit is on plants.	
	Sabadilla	Exempt	20% D	20-35 lb.	do.		—	
MELONS								
Aphids	Malathion	8	5% D 25% WP 50% EC	20-40 lb. 6 lb. 1½ pt.	On foliage.	3	—	L 389
	Nicotine sulfate	2 (nicotine)	40% nicotine soln.	2 pt. in S	do.	—	—	
	Parathion	1	2% D EC or WP	15-30 lb. 1/3 lb. parathion	do.	15	Restriction 2.	

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Dosage (Formulation per acre unless otherwise indicated)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
MELONS (con.)								
Cucumber beetles	Cryolite	7 (fluorine)	50-90% D	20-40 lb. as D 6 lb. cryolite in S	On foliage.	—	—	L 389
	Dieldrin	—	2% D EC or WP	15-30 lb. 1/3 lb. dieldrin	do.	30	—	
	Methoxychlor	14	5% D 50% WP	20-40 lb. 3 lb.	do.	7	—	
	Parathion	1	2% D EC or WP	15-30 lb. 1/3 lb. parathion	do.	15	Restriction 2.	
	Rotenone	Exempt	1% D 4% powder	20-40 lb. 4 lb. in S	do.	—	—	
Leafhoppers	Parathion	1	2% D EC or WP	15-30 lb. 1/3 lb. parathion	do.	15	Restriction 2.	
Leaf miners and thrips	Dieldrin	—	2% D EC or WP	15-30 lb. 1/3 lb. dieldrin.	do.	30	—	
	Parathion	1	2% D EC or WP	15-30 lb. 1/3 lb. parathion	do.	15	Restriction 2.	
Pickleworm	Cryolite	7 (fluorine)	50-90% D	20-40 lb. as D 6 lb. cryolite in S	do.		Only partly effective.	FB 1468
	Rotenone	Exempt	1% D 4% powder	20-40 lb. 4 lb. in S	do.		do.	
Spider mites	Aramite	1	D or WP	½ lb. Aramite	do.	15	—	L 389
	Malathion	8	5% D 25% WP 50% EC	20-40 lb. 6 lb. 1½ pt.	do.	3	—	
	Ovex	—	7.5% D	15-30 lb.	do.	—	Do not apply ovex after harvest begins.	
	Parathion	1	2% D EC or WP	15-30 lb. 1/3 lb. parathion	do.	15	Restriction 2.	

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Dosage (Formulation per acre unless otherwise indicated)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
MINT								
Flea beetles On crop for distillation only	Cryolite	—	50% D	25-30 lb.	On foliage.		Do not feed spent hay from treated crop to livestock.	FB 1988
	DDT	—	5% D	25-30 lb.	do.		do.	
On crop for market or home use	Rotenone	Exempt	1% D	25-30 lb.	do.		—	
MUSKMELON. See Melons.								
MUSTARD								
Aphids	Parathion	1	1% D WP or EC	20-35 lb. ¼ lb. parathion	On foliage as soon as plants appear; repeat weekly.	21	Restriction 2.	
	Malathion	8	5% D 25% WP 50% EC	20-35 lb. 6 lb. 1½ pt.	do.	7		HG 46
	Nicotine sulfate	2 (nicotine)	40% nicotine soln.	2 pt. in S	do.	—		
	Rotenone	Exempt	1% D 5% EC 5% powder	20-35 lb. 2 qt. 5 lb. in S	do.	—		
Caterpillars and flea beetles	Cryolite	7 (fluorine)	50-90% D	20-35 lb. as D	On foliage every 7 to 10 days. Begin on fall plantings in South as soon as plants are up; on other plantings when insects appear.		Do not apply to plants past seedling stage of growth.	
	Rotenone	Exempt	1% D 5% EC 5% powder	20-35 lb. 2 qt. 5 lb. in S	do.		—	
	Toxaphene	—	10-15% D 10% WP 63% EC	20-35 lb. 6-9 lb. 3-5 pt.	do.		Restriction 1.	

VEGETABLE, BRAMBLE, AND STRAWBERRY INSECTS (continued)

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Dosage (Formulation per acre unless otherwise indicated)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
MUSTARD (con.)								
Harlequin bug	Rotenone	Exempt	1% D 5% EC 5% powder	20-35 lb. 2 qt. 5 lb. in S	On foliage.		Only partially effective.	HG 46
	Sabadilla	Exempt	20% D	20-35 lb.	do.		—	
Vegetable weevil	Rotenone	Exempt	1% D 5% EC 5% powder	20-35 lb. 2 qt. 5 lb. in S	do.			
OKRA								
Aphids	Malathion	—	5% D 25% WP 50% EC	20-35 lb. 6 lb. 1½ pt.	On foliage.		Do not apply while pods are on plants.	HG 46 and L 305
	Nicotine sulfate	2 (nicotine)	40% nicotine soln.	2 pt. in S	do.		—	
Blister beetles and corn earworm	Cryolite	7 (fluorine)	50-90% D	20-35 lb. as D 12 lb. cryolite in S	do.		Do not apply while pods are on plants.	
	DDT	7	5% D 50% WP 25% EC	20-35 lb. 3 lb. 3 pt.	do.		do.	
Cucumber beetles and flea beetles	DDT	7	5% D 50% WP 25% EC	20-35 lb. 3 lb. 3 pt.	do.		do.	
	Rotenone	Exempt	1% D 0.025% spray	20-35 lb. —	do.		—	
Japanese beetle	DDT	7	5% D 50% WP 25% EC	20-35 lb. 3 lb. 3 pt.	do.		Do not apply while pods are on plants.	
	Methoxychlor	—	5% D 50% WP 25% EC	20-35 lb. 3 lb. 3 pt.	do.		do.	
Stink bugs	DDT	7	5% D 50% WP 25% EC	20-35 lb. 3 lb. 3 pt.	do.		do.	
	Sabadilla	Exempt	20% D	20-35 lb.	do.		—	

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Dosage (Formulation per acre unless otherwise indicated)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
ONIONS								
Onion maggot	Dieldrin	0.1	WP slurry	½ lb. toxicant/100 lb. seed	To seed in slurry with thiram.		Apply before planting.	
	Heptachlor	0.1	WP slurry	do.	do.		do.	
Thrips	DDT	7	10% D EC or WP	30 lb. 1½ lb. DDT	On foliage every 10-14 days.	—	Do not apply on foliage that is to be eaten.	L 372
	Dieldrin	0.1	1.5% D EC or WP	30 lb. ½ lb. dieldrin	do.	14	do.	
	Heptachlor	0.1	2.5% D EC or WP	30 lb. ½ lb. heptachlor	do.	5	do.	
	Toxaphene	7	20% D EC or WP	30 lb. 2 lb. toxaphene	do.	—	do.	
	Parathion	1	2% D EC or WP	30 lb. ¼ lb. parathion	do.	21	Restriction 2.	
	Malathion	8	5% D EC or WP	30 lb. 3/4 lb. malathion	do.	3	—	
Wireworms	Chlordane	0.3	D, WP, or EC	4-8 lb. chlordane	To soil surface every 2-5 years and work into top 6-9 in.		Apply either before planting or after harvest. DDT recommended only in irrigated lands in West.	FB 1866
	DDT	7	D, WP, or EC	10 lb. DDT				
	Ethylene dibromide	—	40% soln. (dilute 85% soln. with petroleum thinner 3:7 by vol.)	10 gal.	Inject 8 in. into fallow soil every 12 in.		Do not apply within 2 weeks before planting.	
PEAS, BLACKEYE								
Aphids	Malathion	8	5% D 25% WP 50% EC	20-35 lb. 6 lb. 1½ pt.	On foliage.	3	This usage applies to blackeye peas as a vegetable only, not as a forage crop.	HG 46
Cowpea curculio	Methoxychlor	14	5% D 50% WP 25% EC	20-35 lb. 3 lb. 3 pt.	do.	7	do.	

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Dosage (Formulation per acre unless otherwise indicated)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
PEAS, GARDEN								
Aphids	DDT	7	D or EC	1-2 lb. DDT	On foliage.	—	Do not apply DDT to varieties of peas with edible pods after pods form, or vines to be fed to livestock.	FB 1945
	Malathion	8	D or EC	1-1½ lb. malathion	do.	3	—	
	Nicotine sulfate	2 (nicotine)	40% nicotine soln.	2 pt. in S	do.	—	—	
	Parathion	1	1% D EC or WP	25-35 lb. 1/3-1/2 lb. parathion	do.	10	Restriction 2.	
	TEPP	0	1% D	25-35 lb.	do.	3	do.	
	Rotenone	Exempt	1% D	35 lb.	do.	—	—	
Pea moth	Parathion	1	1% D EC or WP	25-35 lb. 1/3-1/2 lb. parathion	do.	10	Restriction 2.	
Pea weevil	DDT	7	5% D	20-25 lb.	To foliage during early bloom period before weevil eggs are laid.	—	Do not apply DDT to varieties with edible pods after pods form, or vines to be fed to livestock.	FB 1971
	Malathion	8	D or EC	1-1½ lb. malathion	do.	3	—	
	Methoxychlor	14	5% D	20-25 lb.	do.	7	—	
	Parathion	1	1% D EC or WP	25-35 lb. 1/3-1/2 lb. parathion	do.	10	Restriction 2.	
PEPPERS								
Aphids	Malathion	8	5% D 25% WP 50% EC	15-30 lb. 6 lb. 1½ pt.	On foliage.	3	—	FB 2051
	Nicotine sulfate	2 (nicotine)	40% nicotine soln.	2 pt. in S	do.	—	—	
	Parathion	1	1% D 15% EC	15-30 lb. 1 pt.	do.	15	Restriction 2.	
	Rotenone	Exempt	1% D 5% powder	15-30 lb. 3 lb. in S	do.	—	—	

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Dosage (Formulation per acre unless otherwise indicated)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
PEPPERS (con.)								
Cutworms (soil)	DDT	7	D, WP, or EC	2 lb. DDT	To soil surface.		Do not apply on plants past seedling stage of growth.	HG 29
	Toxaphene	—	D, WP, or EC 3% B	2 lb. toxaphene 40 lb.	do. Spread on soil (not plants) in late afternoon.		do. —	
Flea beetles	DDT	7	5% D 50% WP	15-30 lb. 3 lb.	On foliage.	5	—	FB 2051
	Methoxychlor	14	5% D 50% WP 25% EC	15-30 lb. 3 lb. 3 pt.	do.	7	—	
	Parathion	1	1% D 15% EC	15-30 lb. 1 pt.	do.	15	Restriction 2.	
	Rotenone	Exempt	1% D 5% powder	15-30 lb. 3 lb. in S	do.	—	—	
Hornworms	TDE	7	10% D 50% WP 25% EC	15-30 lb. 4 lb. 1 gal.	do.	—	Wash peppers as directed in FB 2051.	
Leaf miners	Parathion	1	1% D 15% EC	15-30 lb. 1 pt.	do.	15	Restriction 2.	
Pepper maggot	Parathion	1	1% D 15% EC	15-30 lb. 1 pt.	do.	15	Restriction 2.	
	Rotenone	Exempt	1% D 5% powder	15-30 lb. 3 lb. in S	do.	—	—	
Pepper weevil	DDT	7	10% D 50% WP	15-30 lb. 3 lb.	To infested foliage every 7-10 days.	5		L 226
POTATO								
Aphids	DDT	—	5% D 25% EC 50% WP	20-35 lb. 2½-3 pt. 2-5 lb.	On foliage.	—	—	FB 2040, FB 2098
	Malathion	8	5% D 50% EC 25% WP	20-35 lb. 1½-2 pt. 3-5 lb.	do.	3	—	

Aphids continued on page 43.

VEGETABLE, BRAMBLE, AND STRAWBERRY INSECTS (continued)

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Dosage (Formulation per acre unless otherwise indicated)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
POTATO (con.)								
Aphids (con.)	Nicotine sulfate	—	40% nicotine soln.	1½-2 pt. in S	On foliage.	—	—	FB 2040, FB 2098
	Parathion	—	1% D EC or WP	20-35 lb. ½ lb. parathion	do.	5	Restriction 2.	
	Rotenone	Exempt	0.75-1% D 5% EC 5% powder	20-35 lb. 1½-2 qt. 4-5 lb. in S	do.	—	—	
Armyworms	DDT	—	D, WP, or EC	1½-2 lb. DDT	To nearby infested vegetation before worms reach potato fields.		Restriction 1.	FB 2040
	Toxaphene	—	D, WP, or EC	1½-2 lb. toxaphene				
Blister beetles	Cryolite	—	50-90% D	20-35 lb. as D 8-12 lb. cryolite in S	Dust or spray beetles.			
	DDT	—	D, WP, or EC	1½-2 lb. DDT	do.			
	Methoxychlor	—	5% D 50% WP 25% EC	20-30 lb. 3 lb. 3 pt.	do.			
	Toxaphene	—	D, WP, or EC	2-3 lb. toxaphene	do.			
Colorado potato beetle and flea beetle adults	Calcium arsenate	—	Powder 25% D in lime or talc	5 lb. in S 20-35 lb.	On foliage.			FB 1958, 2034, 2040, and 2098
	Cryolite	—	50-90% D	20-35 lb. as D 8-12 lb. cryolite in S	do.			
	DDT	—	5% D 25% EC 50%	20-35 lb. 2½-3 pt. 2-5 lb.	do.			
	Dieldrin	—	D, EC, or WP	1/2-3/4 lb. dieldrin	do.			
	Heptachlor	0.1	D, EC, or WP	1/2-3/4 lb. heptachlor	do.			
	Paris green	—	10% D in lime Powder	20-35 lb. 4 lb. paris green	do.			
	Rotenone	Exempt	0.75-1% D 5% EC 5% powder	20-35 lb. 1½-2 qt. 4-5 lb. in S	do.			

VEGETABLE, BRAMBLE, AND STRAWBERRY INSECTS (continued)

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Dosage (Formulation per acre unless otherwise indicated)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
POTATO (con.)								
Cutworms	DDT	—	D, EC, or WP	2 lb. DDT	To soil surface.			HG 29
	Toxaphene	—	D, EC, or WP 3% B	2 lb. toxaphene 40 lb.	do. Spread on soil (not plants) in late afternoon.			
European corn borer. See Plant bugs.								
Flea beetles (adults). See Colorado potato beetle.								
Flea beetles (larvae)	Aldrin	0.1	D, G, WP, or EC	2-3 lb. aldrin	To soil surface before planting.			FB 2098
	Chlordane	0.3	D, G, WP, or EC	4-8 lb. chlordane	do.			
	Dieldrin	—	D, G, WP, or EC	2 lb. dieldrin	do.			
	Heptachlor	0.1	D, G, WP, or EC	2-3 lb. heptachlor	do.			
Grasshoppers	Toxaphene	—	D WP or EC	2½ lb. toxaphene 1½ lb. toxaphene	To foliage in and around potato field as needed.		Restriction 1.	FB 2040
Leafhoppers	DDT	—	5% D 25% EC 50%	20-35 lb. 2½-3 pt. 2-5 lb.	On foliage.	—	—	FB 2098
	Malathion	8	5% D 50% EC 25% WP	20-35 lb. 1½-2 pt. 3-5 lb.	do.	3	—	
	Methoxychlor	—	5% D 50% WP 25% EC	20-35 lb. 3 lb. 3 pt.	do.	—	—	
	Parathion	—	1% D EC or WP	20-35 lb. ½ lb. parathion	do.	5	Restriction 2.	

VEGETABLE, BRAMBLE, AND STRAWBERRY INSECTS (continued)

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Dosage (Formulation per acre unless otherwise indicated)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
POTATO (con.)								
Mole crickets	Aldrin	0.1	D, WP, EC, or B	1-2 lb. aldrin	On soil surface preferably before planting.			FB 2098
	Chlordane	0.3	D, WP, EC, or B	1-2 lb. chlordane	do.			
	Dieldrin	—	D, WP, EC, or B	1-2 lb. dieldrin	do.			
	Heptachlor	0.1	D, WP, EC, or B	1-2 lb. heptachlor	do.			
Plant bugs, potato tuberworm, and European corn borer	DDT	—	5% D 25% EC 50%	20-35 lb. 2½-3 pt. 2-5 lb.	On foliage.			
Potato psyllid	DDT	—	5% D 50% WP	20-35 lb. 2 lb.	To foliage of infested fields when plants are 6 in. high; repeat 3 or 4 times at 2-week intervals.			FB 2034
Potato tuberworm. See Plant bugs.								
Vegetable weevil (on foliage)	Aldrin	0.1	D, WP, or EC	3/4 lb. aldrin	On foliage.	—	—	FB 2098
	DDT	—	5% D 25% EC 50% WP	20-35 lb. 2½-3 pt. 2-5 lb.	do.	—	—	
	Parathion	—	1% D EC or WP	20-35 lb. ½ lb. in S	do.	5	Restriction 2.	
White-fringed beetle grubs	Aldrin	0.1	D, G, WP, or EC	2-3 lb. aldrin	To soil surface before planting. Work into top 3-4 in.			
	Chlordane	0.3	D, G, WP, or EC	4-6 lb. chlordane	do.			
	DDT	—	D, G, WP, or EC	10 lb. DDT	do.			
	Dieldrin	—	D, G, WP, or EC	2 lb. dieldrin	do.			
	Heptachlor	0.1	D, G, WP, or EC	2-3 lb. heptachlor	do.			

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Dosage (Formulation per acre unless otherwise indicated)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
POTATO (con.)								
White grubs	Aldrin	0.1	D, G, WP, or EC	2-3 lb. aldrin	To soil surface before planting. Work into top 3-4 in.			FB 2098
	Chlordane	0.3	D, G, WP, or EC	10 lb. chlordane	do.			
	Dieldrin	—	D, G, WP, or EC	2 lb. dieldrin	do.			
	Heptachlor	0.1	D, G, WP, or EC	2-3 lb. heptachlor	do.			
Wireworms In any area	Ethylene dibromide	—	40% soln. (dilute 85% soln. with petroleum thinner 1:7 by vol.)	10 gal.	Inject 8 in. into fallow soil every 12 in.		Do not apply within 2 weeks before planting.	FB 1866
	Chlordane	0.3	D, G, WP, or EC	4-8 lb. chlordane	To soil surface and work into top 6-9 in.		—	
In irrigated lands only	DDT	—	D, WP, or EC	10 lb. DDT	do.			
In South	Aldrin	0.1	D, G, WP, or EC	2-3 lb. aldrin	do.			FB 2098
	Dieldrin	—	D, G, WP, or EC	2 lb. dieldrin	do.			
	Heptachlor	0.1	D, G, WP, or EC	2-3 lb. heptachlor	do.			
PUMPKIN								
Aphids	Nicotine sulfate	2 (nicotine)	40% nicotine soln.	1½ pt. in S	On foliage.	—	—	FB 2086
	Parathion	1	1% D 15% WP	20-40 lb. 1 lb.	do.	15	Restriction 2.	
	TEPP	0	1% D 40% EC	20-40 lb. ½ pt.	do.	3	do.	
Cucumber beetles	Cryolite	7 (fluorine)	50-90% D	20-40 lb. as D 6 lb. cryolite in S	do.	—	Remove excess residues by washing or brushing.	
	Methoxychlor	14	5% D 50% WP	20-40 lb. 3 lb.	do.	7	do	
	Rotenone	Exempt	1% D 4% powder	20-40 lb. 4 lb. in S.	do.	—	—	

VEGETABLE, BRAMBLE, AND STRAWBERRY INSECTS (continued)

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Dosage (Formulation per acre unless otherwise indicated)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
PUMPKIN (con.)								
Cutworms	DDT	7	D, WP, or EC	2 lb. DDT	Apply on soil surface.		Do not apply after plants come up.	FB 2086
	Toxaphene	—	D, WP, or EC	2 lb. toxaphene	do.		do.	
			3% B	40 lb.	Scatter on soil (not plants) late in afternoon.		Do not get on plants.	
Squash bug	DDT	7	5% D	—	To bugs on soil and under trap boards.		Do not apply on plants.	HG 46
	Nicotine sulfate	2 (nicotine)	40% nicotine soln.	1½ pt.	On foliage.		Only partly effective.	FB 2086
	Sabadilla	Exempt	20% D	20-40 lb.	do.		—	
Squash vine borer	Lindane	10	1% D 25% WP	20-30 lb. 1 lb.	Once or twice a week to stems and vines at base of plants.	1	Restriction 5.	
	Methoxychlor	14	5% D 50% WP	20-40 lb. 3 lb.	do.	7	Only partly effective.	FB 2086
	Rotenone	Exempt	1% D 4% powder	20-40 lb. 4 lb.	do.	—	do.	
RADISH								
Root maggots	Chlordane	0.3	5% D 45% EC 50% WP	1½ oz./50 ft. row 3 tsp./gal./200 ft. row 1½ level tbsp./gal./200 ft. row	When first leaves appear; repeat shortly after thinning.	—	Do not apply on plants past seedling stage.	HG 46
RASPBERRY								
Aphids	Malathion	—	5% D 25% WP 50% EC	20-35 lb. 6 lb. 1½ pt.	On foliage.		Do not apply malathion while fruit is on plants.	HG 46
	Nicotine sulfate	2 (nicotine)	40% nicotine soln.	2 pt. in S	do.			

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Dosage (Formulation per acre unless otherwise indicated)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
RASPBERRY (con.)								
Japanese beetle adults and rose chafer	DDT	7	5% D 50% WP 25% EC	20-35 lb. 3 lb. 3 pt.	On foliage.	—	Do not apply DDT while fruit is on plants.	HG 46
	Methoxychlor	14	5% D 50% WP 25% EC	20-35 lb. 3 lb. 3 pt.	do.	7		
Orange tortrix	Cryolite	7 (fluorine)	50-90% D	20-35 lb. as D 15 lb. cryolite in S	To foliage in spring when plants begin to grow.		Do not apply while fruit is on plants.	
	TDE	7	5% D 50% WP	20-35 lb. 6 lb.	do.		do.	
Raspberry and red-necked cane borers	Rotenone	Exempt	0.75% D	20-35 lb.	On foliage just before plants begin to bloom; repeat in about 2 weeks.			
Raspberry fruitworm	Rotenone	Exempt	0.75% D	20-35 lb.	On foliage 7 days after first blossoms; repeat in 10 and 20 days.			
Rose chafer. See Japanese beetle.								
Rose scale	Malathion	—	5% D 25% WP 50% EC	20-35 lb. 6 lb. 1½ pt.	On foliage after harvest.		Do not apply malathion while fruit is on plants.	
	White oil	Exempt	EC	½ cup/gal. water	On dormant plants.			
Stink bugs	DDT	7	5% DDT 50% WP 25% EC	20-35 lb. 3 lb. 3 pt.	On foliage.		Do not apply DDT while fruit is on plants.	
	Sabadilla	Exempt	20% D	20-35 lb.	do.			
RUTABAGA								
Aphids	Malathion	8	5% D 25% WP 50% EC	20-35 lb. 6 lb. 1½ pt.	On foliage when aphids first appear; repeat weekly as long as needed.	7		HG 46

Aphids continued on page 49.

VEGETABLE, BRAMBLE, AND STRAWBERRY INSECTS (continued)

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Dosage (Formulation per acre unless otherwise indicated)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
RUTABAGA (con.)								
Aphids (con.)	Nicotine sulfate	2 (nicotine)	40% nicotine soln.	2 pt.	On foliage when aphids first appear; repeat weekly as long as needed.	--		HG 46
	Parathion	1	2% D	20-35 lb.	On foliage.	21	Restriction 2.	
			EC or WP	½ lb. parathion				
Cabbage looper and other caterpillars	DDT	7	5% D	25 lb.	do.		Restriction 1.	HG 46
			50% WP	2½ lb.				
			25% EC	2½ qt.				
	Rotenone	Exempt	1% D	25 lb.	do.		—	
			5% EC	2 qt.				
			5% powder	5 lb. in S				
Cutworms	DDT	7	D, WP, or EC	2 lb. DDT	To soil surface before planting.		Restriction 1.	
Flea beetles	DDT	7	5% D	25 lb.	On foliage	—	do.	
			50% WP	2½ lb.				
			25% EC	2½ qt.				
	Methoxychlor	14	5% D	25 lb.	do.	7	—	
			50% WP	3 lb.				
			25% EC	3 pt.				
	Rotenone	Exempt	1% D	25 lb.	do.	--	--	
			5% EC	2 qt.				
			5% powder	5 lb. in S				
Root maggots	Chlordane	0.3	5% D	20 lb.	Dust or spray plants as soon as they appear; repeat shortly after thinning.		Restriction 4.	
			45% EC	2½ pt.				
			50% WP	2½ lb.				
Wireworms	Chlordane	0.3	D, WP, or EC	4-8 lb. chlordane	To soil surface and work into top 6-9 in.		Apply either before planting or after harvest.	FB 1866
	DDT	7	D, WP, or EC	10 lb. DDT	do.		DDT recommended only in irrigated lands in West.	

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Dosage (Formulation per acre unless otherwise indicated)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
SOYBEAN, EDIBLE (not as a forage crop)								
Mexican bean beetle	Malathion	—	5% D 25% WP 50% EC	20-35 lb. 6 lb. 1½ pt.	On foliage.	3		FB 1624
	Methoxychlor	—	5% D 50% WP 25% EC	20-35 lb. 3 lb. 3 pt.	do.	7		
	Rotenone	Exempt	1% D 5% powder	20-35 lb. 2½ lb. in S	do.	—		
Velvetbean caterpillar	Methoxychlor	—	5% D 50% WP 25% EC	20-35 lb. 3 lb. 3 pt.	do.	7		L 348
SPINACH								
Aphids	Parathion	1	1% D WP or EC	20-35 lb. ¼ lb. parathion	On foliage.	21	Restriction 2.	
	Malathion	8	5% D 25% WP 50% EC	20-35 lb. 6 lb. 1½ pt.	do.	7		HG 46
	Nicotine sulfate	2 (nicotine)	40% nicotine soln.	2 pt. in S	do.	—		
	Rotenone	Exempt	1% D 5% EC 5% powder	20-35 lb. 2 qt. 5 lb. in S	do.	—		
Beet webworm	Pyrethrum	Exempt	0.2% D EC	20-30 lb. 1/40 lb. pyrethrum	do.			
SQUASH								
Aphids	Malathion	8	5% D 25% WP 50% EC	20-40 lb. 4 lb. 1½ pt.	On foliage.	3	—	FB 2086
	Nicotine sulfate	2 (nicotine)	40% nicotine soln.	1½ pt. in S	do.	—	—	
	Parathion	1	1% D 15% WP	20-40 lb. 1 lb.	do.	15	Restriction 2.	
	TEPP	0	1% D 40% EC	20-40 lb. ⅓ pt.	do.	3	do.	

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Dosage (Formulation per acre unless otherwise indicated)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
SQUASH (con.)								
Cucumber beetles	Cryolite	7 (fluorine)	50-90% D	20-40 lb. in D 6 lb. cryolite in S	On foliage.	—	Remove excess residue by washing or brushing.	FB 2086
	Methoxychlor	14	5% D 50% WP	20-40 lb. 3 lb.	do.	7	do.	
	Rotenone	Exempt	1% D 4% powder	20-40 lb. 4 lb. in S	do.	—	—	
Cutworms	DDT	7	D, WP, or EC	2 lb. DDT	On soil surface, not plants.		Do not apply after plants come up.	
	Toxaphene	—	D, WP, or EC	2 lb. toxaphene	do.		do.	
			3% B	40 lb.	Scatter on soil (not plants) late in afternoon.		Do not get on plants.	
Pickleworm	Cryolite	7 (fluorine)	50-90% D	20-40 lb. as D 8 lb. cryolite in S	On foliage when worms appear in blossoms; repeat weekly.	—	Remove excess residue by washing or wiping.	
	Lindane	10	1% D 25% WP	20-30 lb. 1 lb.	do.	1	Restriction 5.	
	Rotenone	Exempt	1% D	20-40 lb.	do.	—	Only partly effective	
	Sabadilla	Exempt	20% D	20-40 lb.	do.	—	do.	
Squash bug	DDT	7	5% D	—	To bugs on soil and under trap boards.		Do not apply on plants.	HG 46
	Nicotine sulfate	2 (nicotine)	40% nicotine soln.	1½ pt. in S	On foliage		Only partly effective.	FB 2086
	Sabadilla	Exempt	20% D	20-40 lb.	do.		—	
Squash vine borer	Lindane	10	1% D	20-30 lb.	To stems and vines at base of plants at weekly intervals.	1	Restriction 5.	
	Methoxychlor	14	5% D 50% WP	20-40 lb. 3 lb.	do.	7	Only partly effective	
	Rotenone	Exempt	1% D 4% powder	20-40 lb. 4 lb. in S	do.	—	do.	

VEGETABLE, BRAMBLE, AND STRAWBERRY INSECTS (continued)

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Dosage (Formulation per acre unless otherwise indicated)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
STRAWBERRY								
Ants	Chlordane	0.3	Drench: 4 oz. 50% WP or 3 fl. oz. 45% EC/100 gal.	100 gal./1,000 sq. ft.	Drench infested soil.		Do not get on fruit.	HG 28, 46
Aphids	Malathion	8	5% D 25% WP 50% EC	20-35 lb. 6 lb. 1½ pt.	On foliage.	3		HG 46
	Nicotine sulfate	2 (nicotine)	40% nicotine soln.	2 pt. in S	do.	—		
	Parathion	1	2% D EC or WP	20-35 lb. ½ lb. parathion	do.	14	Restriction 2.	
Earwigs	Chlordane	0.3	5% D 50% WP 25% EC	20-35 lb. 3 lb. 3 pt.	To infested soil in and adjacent to planting.	—	Do not allow chlordane to contaminate strawberry fruit or other food.	HG 46
Flea beetles	DDT	7	5% D 50% WP 25% EC	20-35 lb. 3 lb. 3 pt.	On foliage.	—	Do not apply while fruit is on plants.	
	Methoxychlor	14	5% D 50% WP 25% EC	20-35 lb. 3 lb. 3 pt.	do.	7	—	
	Rotenone	Exempt	0.75-1% D 5% powder	20-35 lb. 2½ lb. in S	do.	—	—	
Mole crickets	Chlordane	0.3	3% B	40 lb.	On soil.		—	
			D, WP, or EC	4 lb. chlordane	do.		Do not apply while fruit is present.	
Spider mites	Aramite	1	3% D 15% WP	20-35 lb. 1½ lb.	On foliage.	21		
	Malathion	8	5% D 25% WP 50% EC	20-35 lb. 6 lb. 1½ pt.	do.	3		
Spittlebugs	Methoxychlor	14	. . . . Same as for Flea beetles					
	Rotenone	Exempt	do.					

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Dosage (Formulation per acre unless otherwise indicated)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
STRAWBERRY (con.)								
Strawberry leaf beetle	Methoxychlor	14	. . . . Same as for Flea beetles.					HG 46
	Rotenone	Exempt	do.					
Strawberry root weevil	Chlordane	0.3	. . . . Same as for Mole crickets					
Strawberry weevil	Methoxychlor	14	. . . . Same as for Flea beetles					
White-fringed beetle	DDT	7	D, WP, or EC	10 lb. DDT	To soil surface and work into top 3 in.		Do not get on fruits.	
	Chlordane	0.3	D, WP, or EC	5 lb. chlordane	do.		do.	
White grubs	Chlordane	0.3	D, WP, or EC	10 lb. chlordane	do.		do.	
Wireworms	Chlordane	0.3	D, WP, or EC	4-8 lb. chlordane	To soil surface and work into top 6-9 in. before planting.		DDT recommended only in irrigated lands in West.	FB 1866
	DDT	7	D, WP, or EC	10 lb. DDT				
	Ethylene dibromide	5 (inorganic bromides)	40% soln. (dilute 85% soln. with petroleum thinner 1:7 by vol.)	10 gal.	Inject 8 in. deep into fallow soil every 12 in.		Do not apply within 2 weeks before planting.	
SWEET CORN								
Corn earworm								PS 11
Larvae in silks and ears	DDT	7	1 gal. each of 25% EC and light mineral oil to make 25 gal.	25 gal. as S	Apply 3 times at 3-day intervals beginning on day after silks appear. Wet silks thoroughly.		Do not feed corn treated with DDT as forage to dairy animals or animals being finished for slaughter.	
Larvae in whorl, budworm damage	DDT	7	Reduce amount of oil by half.	25 gal. as S	To entire plant before tasseling and silking.			
European corn borer	DDT	7	EC or WP 5 or 10% D 5% G	1½ lb. DDT 40 or 20 lb. 15-20 lb.	Apply 4 times at 5-day intervals beginning when borers start hatching or begin feeding. Cover plants thoroughly.		do.	FB 2084, Iowa Pamphlet 176
	Ryania	Exempt	40% D	30-40 lb.				
Japanese beetle	DDT	7	25% EC 50% WP 5% D	3 pt. 3 lb. 20-35 lb.	On silks and foliage.		do.	HG 46

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Dosage (Formulation per acre unless otherwise indicated)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
SWEET CORN (con.)								
Wireworms	Chlordane	0.3	D, WP, or EC	4-8 lb. chlordane	To soil surface and work into top 6-9 in. before planting or after harvest.		DDT recommended only in irrigated lands in West.	FB 1866
	DDT	7	D, WP, or EC	10 lb. DDT				
	Ethylene dibromide	—	40% soln. (dilute 85% soln. with petroleum thinner 1:7 by vol.)	10 gal.	Inject 8 in. deep into fallow soil every 12 in.		Do not apply within 2 weeks before planting.	
SWEETPOTATO								
Sweetpotato weevil	Dieldrin	—	2% D	75 lb. in 1 application or 40 lb. in each of 2 applications.	To soil at base of plants in strips 6-8 in. wide.	30		HG 46
	Heptachlor	0.1	2 or 2.5% D	do.	do.	30		
Wireworms	Chlordane	0.3	D, WP, or EC	4-8 lb. chlordane	To soil surface every 2-5 years and work into top 6-9 in.		Apply either before planting or after harvest.	FB 1866
	Ethylene dibromide	50 (inorganic bromides)	40% soln. (dilute 85% soln. with petroleum thinner 1:7 by vol.)	10 gal.	Inject 8 in. into fallow soil every 12 in.		Do not apply within 2 weeks before planting.	
SWISS CHARD								
Beet webworm	Pyrethrum	Exempt	0.2% D EC	20-30 lb. 1/40 lb. pyrethrins	On foliage.			HG 46
Flea beetles	Rotenone	Exempt	1% D 5% powder	20-30 lb. 2½ lb. in S	do.			

VEGETABLE, BRAMBLE, AND STRAWBERRY INSECTS (continued)

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Dosage (Formulation per acre unless otherwise indicated)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
TOMATO, FIELD								
Aphids	Malathion	8	5% D 25% WP 50% EC	20-30 lb. 6 lb. 1½ pt.	On foliage.	3		HG 46
	Nicotine sulfate	2 (nicotine)	40% nicotine soln.	2 pt. in S	do.	—		
	Parathion	1	2% D WP or EC	20-30 lb. ½ lb. parathion	do.	15	Restriction 2.	
Armyworms. See Tomato fruitworm.								
Blister beetles	DDT	7	10% D	20-30 lb.	On beetles.	5		HG 46
	Toxaphene	7	20% D	20-30 lb.	do.	5		
Colorado potato beetle	Cryolite	7 (fluorine)	50-90% D	20-30 lb. as D 12 lb. cryolite in S	On foliage.	5		
	DDT	7	5% D 50% WP 25% EC	20-30 lb. 3 lb. 3 pt.	do.	5		
	Rotenone	Exempt	0.75% D 5% powder	20-30 lb. 2½ lb. in S	do.	—		
Cutworms (in soil)	DDT	7	D, WP, or EC	2 lb. DDT	On soil surface.			
	Toxaphene	7	D, WP, or EC	2 lb. toxaphene	do.			
Flea beetles	Cryolite	7 (fluorine)	50-90% D	20-30 lb. as D 12 lb. cryolite in S	On foliage.	5		
	DDT	7	5% D 50% WP 25% EC	20-30 lb. 3 lb. 3 pt.	do.	5		
	Methoxychlor	14	5% D 50% WP 25% EC	20-30 lb. 3 lb. 3 pt.	do.	7		
	Rotenone	Exempt	0.75% D 5% powder	20-30 lb. 2½ lb. in S	do.	—		
	Toxaphene	7	10% D	30 lb.	do.	5		

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Dosage (Formulation per acre unless otherwise indicated)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
TOMATO, FIELD (con.)								
Hornworms	Cryolite	7 (fluorine)	50-90% D	20-30 lb. as D 12 lb. cryolite in S	On foliage.	5		HG 46, FB 2045
	TDE	7	10% D 50% WP 25% EC	20-30 lb. 4 lb. 1 gal.	do.	5		
	Toxaphene	7	10% D	30 lb.	do.	5		
Leaf miners	Parathion	1	2% D 25% WP 25% EC	20-30 lb. 2 lb. 1 qt.	do.	15	Restriction 2.	L 367
Spider mites	Aramite	1	3% D 15% WP	20-30 lb. 1½ lb.	do.	15		HG 46
	Malathion	8	5% D 25% WP 50% EC	20-30 lb. 6 lb. 1½ pt.	do.	3		
	Parathion	1	2% D 25% WP 25% EC	20-30 lb. 2 lb. 1 qt.	do.	15	Restriction 2.	
Stink bugs	DDT	7	5% D 50% WP 25% EC	20-30 lb. 3 lb. 3 pt.	do.	5		HG 46
	Sabadilla	Exempt	20% D	20-30 lb.	do.	—		
Tomato fruitworm, tomato pinworm, armyworms, and climbing cutworms	Cryolite	7 (fluorine)	B consisting of 1 lb. cryolite in 10 lb. cornmeal	60 lb.	Scatter evenly over foliage. Time as for dusts.	—	Cryolite bait effective against fruitworm only.	L 367
			50-90% D	30 lb. as D 15 lb. cryolite in S	To foliage when first fruits of main crop are setting; repeat in 2 and 4 weeks.	5		
	DDT	7	10% D 50% WP 25% EC	30 lb. 4 lb. 1 gal.	do.	5		
	TDE	7	10% D 50% WP 25% EC	30 lb. 4 lb. 1 gal.	do.	5		

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Dosage (Formulation per acre unless otherwise indicated)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
TOMATO, FIELD (con.)								
Tomato psyllid	DDT	7	5% D 50% WP	25-35 lb. 2 lb.	On foliage when plants are 6 in. high if psyllid is present in area; repeat in 10 and 20 days.	5		FB 2045
Tomato russet mite	Sulfur	Safe	20-50% D Wettable sulfur	30 lb. 10 lb.	On foliage.			L 367
TOMATO, GREENHOUSE								
Aphids	Nicotine sulfate	2 (nicotine)	40% nicotine soln.	2 tsp./gal.	On foliage.	—	—	FB 2082
	Malathion	8	25% WP 50% EC	4 lb./100 gal. 1½ pt./100 gal.	do.	3	—	
			10% aerosol	1 lb./50,000 cu. ft.	In closed greenhouse in air above plants. Temperature should be 70-85°F. and ventilators closed for at least 2 hours.	3	Restriction 6.	
	Parathion	1	10% aerosol	do.		15	Restrictions 2 and 6.	
	Sulfotepp	0	5% aerosol	do.		15	do.	
	TEPP	0	5% aerosol	do.		3	do.	
Armyworms and cabbage looper	DDT	7	3% D	20 lb.	On foliage.	5	—	
			50% WP	2 tbsp./gal.				
	Malathion	8	10% aerosol	1 lb./50,000 cu. ft.	Same as for Aphids.	3	Restriction 6.	
	Parathion	1	10% aerosol	do.	do.	15	Restrictions 2 and 6.	
Cutworms (soil)	DDT	7	10% D	20 lb.	To soil surface.	5		
	Toxaphene	7	10% D	20 lb.	do.	5		
Garden centipede	Lindane	10	25% WP	5 oz./50 gal. per 1,000 sq. ft.	Spray on soil and water it in. For newly set plants, put 1 pint around base of each plant.		Do not use lindane for this purpose except in greenhouses.	
Greenhouse leaf tier	DDT	7	3% D	20 lb.	On foliage.	5		
			5% aerosol	1 lb./50,000 cu. ft.	Same as for Aphids.	5	Restriction 6.	
	Parathion	1	10% aerosol	do.	do.	15	Restrictions 2 and 6.	

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Dosage (Formulation per acre unless otherwise indicated)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
TOMATO, GREENHOUSE (con.)								
Greenhouse whitefly	Malathion	8			Same as for Aphids			FB 2082
	Parathion	1			do.			
	TEPP	0			do.			
Mealybugs	Nicotine sulfate	2 (nicotine)			do.			
	Malathion	8			do.			
	Parathion	1			do.			
	Sulfotepp	0			do.			
	TEPP	0			do.			
Spider mites	Malathion	8			do.			
	Parathion	1			do.			
	Sulfotepp	0			do.			
	TEPP	0			do.			
Thrips	DDT	7	5% aerosol	1 lb./50,000 cu. ft.	Same as for Aphids.	5	Restriction 6.	
			3% D	20 lb.	On foliage.	5	—	
			50% WP	2 tsp./gal.	do.			
	Malathion	8			Same as for Aphids			
	Parathion	1			do.			
Tomato fruitworm and tomato pinworm	DDT	7			Same as for Thrips			
	Parathion	1			Same as for Aphids			
Tomato russet mite	Parathion	1			do.			
	Sulfur	Safe	25-50% D	20 lb.	On foliage.	—	—	

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Dosage (Formulation per acre unless otherwise indicated)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
TURNIP								
Aphids	Malathion	8	5% D 25% WP 50% EC	20-35 lb. 6 lb. 1½ pt.	On foliage when first leaves appear; repeat every 7 days as long as needed.	7		HG 46
	Nicotine sulfate	2 (nicotine)	40% nicotine soln.	2 pt. in S	do.	—		
	Rotenone	Exempt	1% D 5% powder	20-35 lb. 4 lb./100 gal. S	do.	—		
Caterpillars	DDT	7	5% D 50% WP 25% EC	20-35 lb. 3 lb. 3 pt.	On foliage every week or 10 days. On summer or fall plantings in South apply for webworm as soon as true leaves appear.		Restriction 1.	
	Rotenone	Exempt	1% D 5% powder	20-35 lb. 4 lb./100 gal. S			—	
Flea beetles	DDT	7	5% D 50% WP 25% EC	20-35 lb. 3 lb. 3 pt.	On foliage.	—	Restriction 1.	
	Rotenone	Exempt	1% D 5% powder	20-35 lb. 4 lb/100 gal. S	do.	—	—	
	Methoxychlor	14	5% D 50% WP 25% EC	20-35 lb. 3 lb. 3 pt.	do.	7	—	
Root maggots	Chlordane	0.3	5% D 45% EC 50% WP	20 lb. 2½ pt. 2½ lb.	Dust or spray as soon as plants appear; repeat soon after thinning.		Restriction 4.	
Vegetable weevil	DDT	7	5% D 50% WP 25% EC	20-35 lb. 3 lb. 3 pt.	On foliage.	—	Restriction 1.	
	Rotenone	Exempt	1% D 5% powder	20-35 lb. 4 lb./100 gal. S	do.		—	
Wireworms	Chlordane	0.3	D, WP, or EC	4-8 lb. chlordane	To soil surface and work into top 6-9 in.		Apply either before planting or after harvest. DDT recommended only in irrigated lands in West.	FB 1866
	DDT	7	D, WP, or EC	10 lb. DDT				
	Ethylene dibromide	—	40% soln. (dilute 85% soln. with petroleum thinner 1:7 by vol.)	10 gal.	Inject 8 in. deep into fallow soil every 12 in.		Do not apply within 2 weeks before planting.	

FRUIT INSECTS

The recommendations for fruit insects are general and may need to be modified to apply to particular regions of the country. Consult your State agricultural experiment station for more detailed recommendations applicable to your conditions.

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Formulation per 100 gal. of water unless otherwise indicated	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
APPLE								
Aphids, apple and apple grain	DNOC	—	20% EC 40% WP	1½ pt. 1½ lb.	Dormant.	—	—	C 270
	BHC	5	10% gamma WP	2 lb.	Pre-pink or pink.	—	—	
	Lindane	10	25% WP	1 lb.	do.	—	—	
	Parathion	1	15% WP	1 lb.	When aphids become abundant.	14	—	
	Malathion	8	25% WP	2 lb.	do.	3	—	
	Nicotine sulfate	2 (nicotine)	40% nicotine soln.	3/4-1 pt. + hydrated lime 1 lb.	do.	3	—	
	Demeton	0.75	EC (2 lb./gal.)	½-1 pt.	do.	21	Do not make more than 2 applications after first cover.	
Aphid, rosy apple	DNOC	—	20% EC 40% WP	1½ pt. 1½ lb.	Dormant.	—	—	
	BHC	5	10% gamma WP	2 lb.	Pre-pink or pink.	—	—	
	Parathion	1	15% WP	1 lb.	do.	—	Do not use on McIntosh or related varieties.	
	Malathion	8	25% WP	2-2½ lb.	Pre-pink or pink or when aphids appear.	3	—	
	Demeton	0.75	EC (2 lb./gal.)	½-1 pt.	do.	21	Same as for other apple aphids.	
Aphid, woolly apple	BHC	5	10% gamma WP	2 lb.	In first cover spray, if aphids are present.	—	Later application may impart off-flavor to fruit.	
	Lindane	10	25% WP	1 lb.				
	Malathion	8	25% WP	2-2½ lb.	When aphids appear.	3	—	
	Parathion	1	15% WP	1 lb.	do.	14	—	

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Formulation per 100 gal. of water unless otherwise indicated	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
APPLE (con.)								
Apple flea weevil	DDT	7	50% WP	2 lb.	Pre-pink or pink.		On McIntosh or related varieties use DDT instead of parathion.	
	Parathion	1	15% WP	1 lb.	do.			
Apple lace bug	Nicotine sulfate	2 (nicotine)	40% nicotine soln.	3/4 pt. + hydrated lime 1 lb.	When lace bugs are present.	3		C 270
Apple and thorn skeletonizer	DDT	7	50% WP	2 lb.	1-2 applications early in spring when young caterpillars appear.			
	Lead arsenate	7 (combined lead)	Powder	2 lb.	do.			
Apple maggot	DDT	7	50% WP	2 lb.	3 applications 10 days apart beginning when flies appear.	40		
	Lead arsenate	7 (combined lead)	Powder	3 lb. + hydrated lime 3 lb.	2-3 applications 10-14 days apart beginning when flies appear.	40		
	Lead arsenate + DDT	7 (combined lead) +7	Powder + 50% WP	3 lb. + 2 lb.	2-3 applications 14 days apart beginning when flies appear.	40		
	Methoxychlor	14	50% WP	2 lb.	3-5 applications, as needed, 10 days apart beginning when flies appear.	14		
Apple red bug	DDT	7	50% WP	2 lb.	At petal fall.			
	Nicotine sulfate	2 (nicotine)	40% nicotine soln.	1 pt.	do.			
Bagworm	Chlordane	0.3	50% WP	2 lb.	In May or June when young first appear.			
	Lead arsenate	7 (combined lead)	Powder	3-4 lb.	do.			

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Formulation per 100 gal. of water unless otherwise indicated	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
APPLE (con.)								
Borer, roundheaded apple-tree	Lead arsenate	7 (combined lead)	Powder	3 lb.	About 3 weeks after petal fall and 2-3 weeks later.			L 274
	Dichloroethyl-ether	—	100%	—	In fall inject into borer tunnels; in spring examine trees and treat tunnels missed in fall.			
	Paradichlorobenzene + carbon disulfide	—	1:1 mixture	—	do.			
	Pyrethrum	Exempt	1.5-2.5% alcohol extract of pyrethrins	—	do.			
	Rotenone	Exempt	1.5% extract	—	do.			
Borer, shot-hole	DDT	7	50% WP	2 lb.	Two, when adults are active in May and in September.	40	Do not make fall application until crop is harvested.	C 270, FB 1861, L 274
	Parathion	1	15% WP	2 lb.		14		
Cankerworms, fall and spring	DDT	7	50% WP	1 lb.	Pink.			L 183
	Lead arsenate	7 (combined lead)	Powder	3 lb.	do.			
Codling moth	Pacific Northwest							
	DDT	7	50% WP	1-2 lb.	2-4 cover sprays, first about 3 weeks after calyx and others at about 3-week intervals.	40		C 270
	Methoxychlor	14	50% WP	3 lb.	do.	14		

Codling moth continued on page 63.

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Formulation per 100 gal. of water unless otherwise indicated	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
APPLE (con.)								
Codling moth (con.)	Other areas							
	DDT	7	50% WP	2 lb.	3 or 4 at 10-14 day intervals beginning about 10-14 days after calyx for first brood; 1-3 at 10-12 day intervals for second and third broods.	40	After 5 DDT sprays change to other than a chlorinated hydrocarbon insecticide for additional covers.	C 270
	DDT + parathion	7 + 1	50% WP + 15% WP	1½ lb. + ½-1 lb.		40		
	Parathion	1	15% WP	1½ lb.	do.	14	—	
	EPN	3	25% WP	1 lb.	3-4 at 10-12 day intervals beginning at petal fall for first brood; 1-3 at 10-14 day intervals for second and third broods.	15	Do not use on McIntosh and related varieties.	
	Lead arsenate	7 (combined lead)	Powder	3 lb.	do.	40	Use only to control light infestations or where it has been satisfactory. Change to another material to control second and third brood if fruit is not to be washed.	
	Ryania	Exempt	Powder	5-6 lb.	do.	7	Suggest for trial to control strains resistant to DDT or for late applications to avoid excessive residues of other materials at harvest.	
Climbing cutworms	DDT	7	10% D	Small handful	On trunk and at ground about base of tree when opening buds are attacked.			
Eye-spotted bud moth	Lead arsenate	7 (combined lead)	Powder	3 lb.	1 or 2 at 10-day interval at pink or when buds are pushing out.			

FRUIT INSECTS (continued)

						Restrictions		
Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Formulation per 100 gal. of water unless otherwise indicated	Application	Min. days from last application to harvest or feeding	Other	References
APPLE (con.)								
Fall webworm	DDT	7	50% WP	2 lb.	Midsummer, when webs are first noticed.	40		C 270
	Lead arsenate	7 (combined lead)	Powder	2 lb.	do.	40		
Fruitworms	DDT	7	50% WP	2 lb.	Calyx or first cover.			
	Lead arsenate	7 (combined lead)	Powder	3 lb.	do.			
Grasshoppers	Chlordane	0.3	40% WP	2½ lb.	Spray orchard ground cover and fence rows with 100 gal./acre when hoppers become numerous.	15		
	Parathion	1	15% WP	2½ lb.		14		
	Toxaphene	7	60% EC	1/3 gal.		30		
Japanese beetle	DDT	7	50% WP 25% EC 5% D	2 lb. 2 qt. 30 lb./acre	When beetles appear; repeat 10-14 days later if infestation continues.	40	—	FB 2004, PS 4
	Methoxychlor	14	50% WP 25% EC	3 lb. 3 qt.	do.	14	—	
	Parathion	1	15% WP	2 lb.	do.	14	—	
	Rotenone	Exempt	4% powder	3 lb.	When beetles appear; repeat at 7-10 day intervals as long as infestation continues.	3	Do not use near ponds or streams containing fish.	
Leafhoppers	DDT	7	50% WP	1 lb.	1-2 when leafhoppers appear.	40	—	C 270
	Nicotine sulfate	2 (nicotine)	40% nicotine soln.	½-1 pt.	do.	3	Use with soap or hydrated lime.	
	Parathion	1	15% WP	1 lb.	do.	14	—	
Leafroller, fruit tree	DDT	7	50% WP	2 lb.	When buds begin to separate.			
	Lead arsenate	7 (combined lead)	Powder	4 lb.	do.			

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Formulation per 100 gal. of water unless otherwise indicated	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
APPLE (con.)								
Leafroller, red-banded	Lead arsenate	7 (combined lead)	Powder	3 lb.	Calyx and first cover.	—	—	C 270
	Parathion	1	15% WP	1 lb.	Calyx and first cover and fifth or sixth cover.	14	Do not use on McIntosh or related varieties.	
	TDE	7	50% WP	1½ lb.	Calyx and fifth or sixth cover.	40	—	
Mite, clover	Mineral oil	Exempt	EC or emulsion	3% oil	Delayed dormant.	—		
	Aramite	1	15% WP	1½ lb.	When mites appear in numbers; repeat if infestation persists.	14		
	Malathion	8	25% WP	2-2½ lb.	do.	7		
	Sulphenone	8	50% WP	1½-2 lb.	do.	21		
Mite, European red	Mineral oil	Exempt	EC or emulsion	3% oil	Late dormant—delayed dormant.	—	—	
	Ovex	—	50% WP	¼ lb. ½ lb.	Pink, calyx. First cover.	—	—	
	Demeton	0.75	EC (2 lb./gal.)	½-1 pt.	Pink and later as needed; summer applications can be 21 days apart.	21	Limit to 2 applications after crop is present.	
	Aramite	1	15% WP	1½ lb.	In cover sprays.	14	—	
	Chlorobenzilate	5	25% WP	1¼-1½ lb.	do.	14 (tentative)	—	
	EPN	3	25% WP	½-3/4 lb.	In cover sprays; 2 applications 7-10 days apart.	15	Do not use on McIntosh or related varieties or if phosphorus-resistant strains of mites are present.	
	Parathion	1	15% WP	1 lb.	do.	14	do.	
	Malathion	8	25% WP	2-2½ lb.	do.	7	Do not use if phosphorus-resistant strains of mites are present.	
	TEPP	0	20% EC or 40% EC	½-2/3 pt. ¼-1/3 pt.	In cover sprays; 2-3 applications 7 days apart.	3	Do not use with lime.	

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Formulation per 100 gal. of water unless otherwise indicated	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
APPLE (con.)								
Mites, two-spotted spider, four-spotted spider, McDaniel, Schoeni, and others	Aramite	1	15% WP	1½ lb.	In cover sprays when infestation threatens.	14	—	C 270
	Demeton	0.75	EC (2 lb./gal.)	½-1 pt.	do.	21	Limit to 2 applications after crop is set.	
	Chlorobenzilate	5	25% WP	1¼-1½ lb.	In cover sprays; 2 applications 7-10 days apart.	14 (tentative)	—	
	EPN	3	25% WP	½-3/4 lb.	In cover sprays when infestation starts, or at half strength in second, third, and fourth, or third, fourth, and fifth cover sprays to prevent or delay infestation.	15	Do not use on McIntosh or related varieties or if phosphorus-resistant strains are present.	
	Parathion	1	15% WP	1 lb.	do.	14	do.	
	Malathion	8	25% WP	2-2½ lb.	do.	7	Do not use if phosphorus-resistant strains are present.	
	TEPP	0	20% EC or 40% EC	½-2/3 pt. ¼-1/3 pt.	In cover sprays; 2-3 applications 7 days apart.	3	Do not use with lime.	
Mite, pear leaf blister	Lime sulfur	Safe	Liquid	8 gal. 32° Be. or equivalent to give 3½° Be. in dilute spray.	In fall when mites are migrating from leaves to buds or late in dormant season just as buds are swelling.			C 270, FB 1739
	Mineral oil	Exempt	EC or emulsion	3% oil	Just as buds are swelling.			
Periodical cicada	TEPP	0	40% EC	¼-½ pt.	Late May or early June when adults start emerging; repeat every 3-5 days as necessary.		Spray early in morning before cicadas become active.	L 340

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Formulation per 100 gal. of water unless otherwise indicated	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
APPLE (con.)								
Plum curculio	Dieldrin	0.1	50% WP	½ lb.	1-3 every 7-10 days beginning at petal fall.		Do not use after first cover.	YB 1952
	EPN	3	25% WP	1½ lb.	do.		Do not use on McIntosh or related varieties; may russet Golden Delicious and other tender varieties.	
	Parathion	1	15% WP	1½-2 lb.	do.		do.	
	Lead arsenate	7 (combined lead)	Powder	3 lb. + hydrated lime 3 lb.	do.		—	
	Methoxychlor	14	50% WP	3 lb.	do.		—	
Scales, Forbes, Putnam, and San Jose	Mineral oil	Exempt	EC or emulsion	3% oil	Dormant or delayed dormant. If "Superior" oil is used, 2% is effective. In Pacific Northwest dormant application of 1% oil with 3% liquid lime sulfur is effective.	—		
	Malathion	8	25% WP	2-2½ lb.	3, when crawlers are present, about second, fifth, and sixth, or second, sixth, and seventh covers.	7		
	Parathion	1	15% WP	½-1 lb.	do.	14		
			25% WP	1 lb.	One in 2-week period prior to pre-pink of pears.	—	Applies to Pacific Northwest.	

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Formulation per 100 gal. of water unless otherwise indicated	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
APPLE (con.)								
Scales, oyster shell and scurfy	Mineral oil	Exempt	EC or emulsion	3-4% oil	Dormant.		4% oil in Pacific Northwest.	C 270
	DDT	7	50% WP	2 lb.	When eggs are hatching, usually calyx and first cover.		—	
	Parathion	1	15% WP	2 lb.	do.		Do not use on McIntosh or related varieties; may russet Golden Delicious and other tender varieties.	
Tent caterpillars Eastern	DDT	7	50% WP	2 lb.	When caterpillars appear in early spring.			L 161
Western	DDT	7	50% WP	2 lb.	Just before bloom.			C 270
Treehoppers	Mineral oil	Exempt	EC or emulsion	4% oil	Dormant.			
Yellow-necked caterpillar	Parathion	1	15% WP	½ lb.	When young appear, usually July and August.	14		
APRICOT	. . . . Same as for Peaches						Do not use Aramite on apricots after fruit forms.	
BLUEBERRY								
Bud mite	Summer oil	Exempt	EC or emulsion	2% oil	2, in late August and late September.			
Blossom weevil	Dieldrin	—	25% WP	2 lb.	When leaf buds show green and 7-9 days later.			
	Parathion	1	15% WP 1% D	1½ lb. 25-35 lb./acre				
Blueberry maggot	Calcium arsenate	3.5 (As_2O_3)	50% D	6-7 lb./acre	2 at 10-day intervals, first 7-10 days after flies appear in numbers.	14	Use only on fruit to be processed, and remove residue before processing.	FB 1951
	Rotenone	Exempt	2% D	25 lb./acre	As above, but 3 or 4 applications.	3	—	

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Formulation per 100 gal. of water unless otherwise indicated	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
BLUEBERRY (con.)								
Cherry fruitworm, cranberry fruitworm, plum curculio, and sharp-nosed leafhopper	Methoxychlor	14	50% WP 5% D	3 lb. 25 lb./acre	When largest berries of earliest varieties are about ¼ in. in diameter and 7-10 days later.	14		FB 1951
	Parathion	1	15% WP 1% D	1½-2 lb. 25-35 lb./acre		14		
Cranberry rootworm	Chlordane	0.3	5% D	200 lb./acre 2 oz./plant	Disk in before planting. Work into soil within 2 ft. of plant.			
	DDT	7	5% D	500 lb./acre 6 oz./plant	Same as for chlordane. do.			
Scale insects	Lime sulfur	Exempt	Liquid	1 gal. in 9 gal. water	Dormant.			
CHERRY								
Black cherry aphid	DNOC	0	40% WP or 20% EC	1½ lb. 1½ qt.	Dormant.			C 270
	Malathion	8	25% WP	2 lb.	2 at 10-14 day intervals, first when aphids appear about time buds are breaking.			
	Nicotine	2 (nicotine)	40% nicotine soln.	3/4 pt.				
	Parathion	1	15% WP	1 lb.	do.			
	TEPP	0	40% EC or 20% EC	¼ pt. ½ pt.	do.			
Cherry fruitworm	Methoxychlor	14	50% WP	2 lb.	4 weeks after petal fall.	14		
Fruit flies, cherry and black cherry					Begin all treatments when first adults are trapped.			
	Lead arsenate	7 (combined lead)	Powder	2½-3 lb. + lime 3 lb.	2-3 applications at 10-14 day intervals.	14	Use only on fruit to be processed, and remove residue before processing. Reduce to 1 lb. in spray on English Morello variety.	C 270
		7	10% D	40 lb./acre	3-4 applications at 10-day intervals.	14		
	Malathion	8	25% WP	2 lb.	2-3 applications at 10-day intervals.	3	—	
	Methoxychlor	14	50% WP	2 lb.	do.	7	—	

Fruit flies continued on page 70.

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Formulation per 100 gal. of water unless otherwise indicated	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
CHERRY (con.)								
Fruit flies (con.)	Parathion	1	15% WP	1-2 lb.	2-3 applications at 10-day intervals.	14		C 270
	Parathion + methoxychlor	1 + 14	15% WP + 50% WP	1 lb. + 1 lb.	do.	14		
	Rotenone	Exempt	4-4.5% powder 0.75% D	2-3 lb. 40 lb./acre	2-4 applications at 7-10 day intervals.	3		
Pandemis moth	DDT + parathion	7 + 1	50% WP + 15% WP	2 lb. + ½ lb.	Just before bloom.			
Pear-slug	DDT	7	50% WP	2 lb.	1-2, first about 20 days after bloom.	30	—	C 270
	EPN	3	25% WP	1 lb.	do.	15	—	
	Lead arsenate	7 (combined lead)	Powder	2 lb. + lime 2 lb.	do.	30	Reduce to 1 lb. on English Morello variety.	
	Parathion	1	15% WP	1½ lb.	do.	14	—	
Pear thrips	DDT	7	50% WP 5% D	2 lb. 40 lb./acre	1-3, first just after buds show green as buds begin to show white and just after bloom.	30		
Plum curculio	EPN	3	25% WP	1-1½ lb.	2-3 at 8-10-day intervals beginning at petal fall or shuck split.	14	—	
	Methoxychlor	14	50% WP	2 lb.	do.	14	—	
	Parathion	1	15% WP	2 lb.	do.	14	—	
	Lead arsenate	7 (combined lead)	Powder	2-3 lb. + lime 2-3 lb.	Petal fall, shuck fall.	30	Reduce to 1 lb. on English Morello variety.	

FRUIT INSECTS (continued)

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Formulation per 100 gal. of water unless otherwise indicated	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
CHERRY (con.)								
Scales, San Jose and Forbes	Mineral oil	Exempt	EC or emulsion	3% oil	Dormant.	—	—	C 270
	Malathion	8	25% WP	2-2½ lb.	3 weeks before and immediately after harvest.	3	—	
	Parathion	1	25% WP	1 lb.	2 weeks prior to prepink of pears.	14	Applies to Pacific Northwest.	
			15% WP	½-1 lb.	3 weeks before and immediately after harvest.	14	—	
Shot-hole borer	DDT	7	50% WP	2 lb.	2, when adults are active in May and in September.	40	Do not make fall application until crop is harvested.	C 270, FB 1861, L 274
	Parathion	1	15% WP	2 lb.		14		
CITRUS	. . . . .Results of USDA research are made available to local groups issuing recommendations.							
CURRANT AND GOOSEBERRY								
Currant aphid	Nicotine sulfate	2 (nicotine)	40% nicotine soln.	1 pt.	As leaf buds are opening.			
Imported currantworm	Lead arsenate	7 (combined lead)	Powder 10-15% D	2 lb. 20-25 lb./acre	Soon after leaves are out.	—	Do not apply when fruit is present.	
	Rotenone	Exempt	4-5% WP	3 lb.	When worms appear.	3	—	
San Jose scale	Lime sulfur	Safe	Liquid	1 gal. in 7-8 gal. water	Dormant.			FB 1676
	Mineral oil	Exempt	EC or emulsion	2% oil	do.			
GRAPE								
Climbing cutworms	DDT	7	50% WP	2 lb.	Just as buds are swelling.			FB 1893
			10% D	Small handful.	To lower part of vine and ground below as buds are swelling.			

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Formulation per 100 gal. of water unless otherwise indicated	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
GRAPE (con.)								
European fruit lecanium	EPN	3	25% WP	1 lb.	When eggs have just hatched and nymphs are migrating over vines, usually shortly after bloom.			
	Parathion	1	15% WP	1 lb.				
Grape berry moth	DDT	7	50% WP	1½ lb.	At petal fall, 7-14 days later, when second brood eggs are found (35-45 days after bloom), and 14 days later. (A sticker may be used according to manufacturers' directions in first 2 applications but not later.)	40	Do not use a sticker with DDT after grapes reach buckshot size.	FB 1893
	DDT + parathion	7 + 1	50% WP + 15% WP	1½ lb. + 1 lb.		40		
	EPN	3	25% WP	1 lb.		15	—	
	Methoxychlor	14	50% WP	2 lb.		14	—	
	Methoxychlor + parathion	14 + 1	50% WP + 15% WP	2 lb. + 1 lb.		14		
	Parathion	1	15% WP	1 lb.		14	Do not use bordeaux mixture with parathion.	
Grape flea beetle	DDT	7	50% WP	2 lb.	In early spring when buds begin to swell if adults appear, or when shoots are 6-8 in. long if larvae are present.	40		
Grape leaf folder	DDT	7	50% WP	1½ lb.	When adults or small larvae are observed; schedule for grape berry moth gives control.	40		
Grape leafhopper and rootworm	DDT	7	50% WP	1½ lb.	Same as petal fall and first-cover spray for grape berry moth.	40		
Grape mealybug	EPN	3	25% WP	1½ lb.	1 or 2 applications 7-10 days apart when overwintering nymphs move out from under bark to base of buds onto grape clusters (may be just before or after bloom).			
	Parathion	1	15% WP	1 lb.				

FRUIT INSECTS (continued)

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Formulation per 100 gal. of water unless otherwise indicated	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
GRAPE (con.)								
Grape phylloxera (leaf form only)	Lindane	10	25% WP	2 lb.	When galls first appear on leaves, 2 applications 7-10 days apart.	60		
Grapevine aphid	Nicotine sulfate	2 (nicotine)	40% nicotine soln.	1 pt. with soap or Bordeaux mixture	When aphids appear on shoots.	3		FB 1893
	Parathion	1	15% WP	1 lb.	do.	14		
Japanese beetle	. . . . .Same as for Apple							FB 2004
Leaf-eating caterpillars	Lead arsenate	7 (combined lead)	Powder	3 lb.	If regular program is not effective add to second, third, or fourth application.		No application later than 21 days after bloom.	FB 1893
Red-banded leaf roller	Lead arsenate	7 (combined lead)	Powder	3 lb.	Add to second (just before bloom) or third (petal fall) application.		do.	
	Parathion	1	15% WP	2 lb.		14	--	
Rose chafer	DDT	7	50% WP	2 lb.	When adults first appear (usually near time of bloom of Concord grapes).			
Two-spotted spider mite	Malathion	8	25% WP	2 lb.	When mites first appear on leaves, and 7 days later if infestation is heavy.	3		
	Parathion	1	15% WP	½-1 lb.				
MANGO								
Oriental fruit fly	Malathion	8	25% WP	3 lb./40-150 gal./acre + 1 lb. yeast protein or 2 lb./3-40 gal./acre + 1 lb. yeast protein	Every 2 weeks while flies are on fruit.	2		ARS-33-3
PASSION FRUIT								
Oriental fruit fly and melon fly	. . . . .Same as for Mango							

FRUIT INSECTS (continued)

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Formulation per 100 gal. of water unless otherwise indicated	Application	Restrictions: Min. days from last application to harvest or feeding	Restrictions: Other	References
PEACH								
Aphids, green peach	Mineral oil	Exempt	EC or emulsion	4% oil	When buds are swelling.			FB 1676, 1861, C 270
Aphids, green peach, black cherry, black peach, rusty plum	Malathion	8	25% WP	2 lb.	Early in season when aphids appear.			
	Parathion	1	15% WP	1 lb.	do.			
	Nicotine sulfate	2 (nicotine)	40% nicotine soln.	3/4 pt.	do.			
Borer, American plum	EPN	3	25% WP	2 lb.	3-4 at 21-day intervals beginning in June.	15		
	Parathion	1	15% WP	3 lb.		14		
Borer, lesser peach tree	EPN	3	25% WP	2 lb.	4 to trunks and scaffold limbs at 21-day intervals, beginning with emergence in June. In Georgia 2 each for first (April and May) and second (August and September) broods.	15		FB 1861
	Parathion	1	15% WP	3 lb.		14		
Borer, peach tree	DDT	7	50% WP	6-8 lb.	In latitude of Virginia and northward, 2 to trunks (July 1-15 and about 3 or 4 weeks later); southward 3 (July 10-15 and after 3- or 4-week intervals); in south Georgia 4 at 4-week intervals, beginning August 1.	21	If harvest interferes with application, postpone until just after harvest is completed; avoid hitting fruit with spray.	
	EPN	3	25% WP	2 lb.		15		
	Parathion	1	15% WP	2-3 lb.		14		
	Ethylene dichloride	--	50% EC	1/8 pt. 7.5% emulsion for 1-year-old trees to ½ pt. 20% emulsion for trees 4 years and older.	To ground in ring around trunk in fall or during first warm spell in spring.	—	Do not use in heavy, damp soil.	
	Paradichlorobenzene	--	Crystals	½-1½ oz./tree, depending on age and size.	To ground in ring around trunk in late August to early September in northern areas; to late October in more southern areas.	—	Keep crystals from touching trees.	

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Formulation per 100 gal. of water unless otherwise indicated	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
PEACH (con.)								
Borer, peach twig	Lime sulfur	Safe	Liquid	3½° Be. or 1 part lime sulfur to 10 parts water	Before pink stage of blossom buds.		Do not use on apricots.	C 270, FB 1861
	Basic lead arsenate	7 (combined lead)	Powder	3 lb. or 4 lb.	Just before bloom. Petal fall.		—	
	DDT	7	50% WP	2 lb.	Petal fall.		—	
Borer, shot-hole	DDT	7	50% WP	2 lb.	When beetles are active, usually in late May or June and September.	28	Do not make more than 1 application within 6 weeks of harvest and make it at least 4 weeks before.	
	DDT + parathion	7 + 1	50% WP + 15% WP	1 lb. + 1½ lb.		28		
	Parathion	1	15% WP	2 lb.	do.	14	—	
Climbing cutworms	DDT	7	10% D		Small handful on lower trunk and surrounding ground soil in early spring when worms appear.			C 270
Earwigs	DDT	7	10% D		Thoroughly to trunk and surrounding soil about a month before fruit ripens.	28	Do not get dust on fruit.	
Grasshoppers	. . . . Same as for Apple							
Japanese beetle					do.			
Leaf roller, red-banded, and *Platynota flavedana*	Parathion	1	15% WP	2 lb.	When leaf rollers become active, about July 1.	14		
	TDE	7	50% WP	1½ lb.		21		
Mites, European red and two-spotted spider	Mineral oil	Exempt	EC or emulsion	3% oil	Dormant.	—		FB 1676, C 270
	Aramite	1	15% WP	1½ lb.	In summer 1-2 applications 7-10 days apart.	14 (tentative)		
	EPN	3	25% WP	½-1 lb.	do.	15		
	Malathion	8	25% WP	2-2½ lb.	do.	7		
	Parathion	1	15% WP	1 lb.	do.	14		
	TEPP	0	40% EC 20% EC	1/3 pt. 2/3 pt.	do.	3		

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Formulation per 100 gal. of water unless otherwise indicated	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
PEACH (con.)								
Oriental fruit moth	DDT	7	50% WP	2 lb.	Pacific Northwest. 2-3 applications—at petal fall, 12-14 days later, and, if infestation warrants, in June when moths appear in bait traps. Other areas. 3 applications at 10-day intervals beginning at shuck split or 2 applications 6-8 and 4 weeks before harvest.	28	— If DDT is used against second and third broods, do not make more than 1 application within 6 weeks of harvest and make it at least 4 weeks before harvest.	C 270, FB 1861
	EPN	3	25% WP	1½ lb.	3 applications at 10-day intervals beginning at shuck split or 2 applications 6 and 2-3 weeks before harvest.	15	—	
	Parathion	1	15% WP	1½-2 lb.		14	—	
Pandemis moth	Parathion	1	25% WP	½ lb.	In early spring as soon as worms are found in trees.			C 270
Periodical cicada	TEPP	0	. . . . Same as for Apple					L 340
Plum curculio	EPN	3	25% WP	1-1½ lb.	In southern areas at petal fall, 10 days later, 7-10 days later and 4-5 weeks and 2 weeks prior to harvest; in northern areas 3-4 applications 7-10 days apart beginning at shuck-off.	15	—	FB 1861
	Methoxychlor	14	50% WP	3 lb.		21	—	
	Parathion	1	15% WP	1½-2 lb.		14	—	
	Dieldrin	0.1	50% WP	½ lb.	Can be substituted for EPN or parathion in petal fall and first cover.	—	Do not use after first cover spray.	

Plum curculio continued on page 77.

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Formulation per 100 gal. of water unless otherwise indicated	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
PEACH (con.)								
Plum curculio (con.)	Lead arsenate	7 (combined lead)	Powder	2 lb. + lime 8 lb.	In southern areas at petal fall, 10 days later, 7-10 days later, and 1 month before harvest; in northern areas 3 applications 7-10 days apart beginning at shuck-off.	30		FB 1861
	Cryolite	7 (fluorine)	Powder	4 lb.	2 applications 2 weeks apart after harvest if infestation is heavy.			
Scales, European fruit, lecanium, and terrapin	Mineral oil	Exempt	EC or emulsion	4% oil	Dormant.	—		FB 1676, 1861, C 270
	Malathion	8	25% WP 50% EC	2-2½ lb. 1 qt.	At completion of hatching, about last of June.	7		
	Parathion	1	15% WP	2 lb.	do.	14		
Scales, Forbes, San Jose, and white peach	. . . . Same as for Apple							FB 1676, 1861, C 270
Stink bugs	Dieldrin	0.1	50% WP	½ lb.	At petal fall and first cover.		Do not use dieldrin after first cover.	FB 1861
	EPN	3	25% WP	1½ lb.	As for first-brood plum curculio.			
	Parathion	1	15% WP	2 lb.	do.			
Tarnished plant bug	DDT	7	50% WP	2 lb.	At petal fall and 8-10 days later.		—	
	Dieldrin	0.1	50% WP	½ lb.	do.		Do not use dieldrin after first cover.	
	EPN	3	25% WP	1-1½ lb.	do.		—	
	Parathion	1	15% WP	1½-2 lb.	do.		—	

FRUIT INSECTS (continued)

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Formulation per 100 gal. of water unless otherwise indicated	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
PEAR								
Borers	Same as for Apple							
Climbing cutworms	do.							
Codling moth	DDT	7	50% WP	2 lb.	2-4 cover sprays beginning with first cover.	30		C 270, FB 1739
	EPN	3	25% WP	1 lb.	do.	15		
	Methoxychlor	14	50% WP	3 lb.	do.	14		
	Parathion	1	15% WP	1½ lb.	do.	14		
	Lead arsenate	7 (combined lead)	Powder	3 lb.	2-4 cover sprays beginning with calyx.	40		
Fruit-tree leaf roller	Same as for Apple							
Pear leaf blister mite	do.							
Pear leaf worm	Lead arsenate	7 (combined lead)	Powder	2 lb.	At petal fall.			C 270
Pear midge	DDT	7	50% WP	2 lb.	2 applications 7 days apart, first just before sepals separate on most advanced buds.			
Mites, clover, European red, two-spotted spider, McDaniel, and related species.	Same as for Apple							
Pear psylla	Mineral oil	Exempt	EC or emulsion	2% oil	Late dormant.	—		C 270, FB 1739
	Rotenone + summer oil	Exempt	5% WP + EC or emulsion	2 lb. + 2 qt.	In summer when psylla occurs in numbers.	3		
	EPN	3	25% WP	1 lb.	At petal fall and during summer when psylla appears in numbers.	15		
	Malathion	8	25% WP	2 lb.		7		
	Parathion	1	15% WP	1 lb.		14		

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Formulation per 100 gal. of water unless otherwise indicated	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
PEAR (con.)								
Pear-slug	DDT	7	50% WP	2 lb.	About 2 weeks after bloom.			C 270, FB 1739
	EPN	3	25% WP	1 lb.	do.			
	Parathion	1	15% WP	1½ lb.	do.			
	Lead arsenate	7 (combined lead)	Powder	2 lb.	do.			
Pear thrips	DDT	7	50% WP 5% D	2 lb. Thorough coverage.	When about half of buds are in green-tip stage.			
Plum curculio	EPN	3	25% WP	1½ lb.	At petal fall and 10 days later.			
	Parathion	1	15% WP	2 lb.	do.			
	Lead arsenate	7 (combined lead)	Powder	3 lb.	do.			
Scales, Forbes, San Jose, and scurfy	. . . . Same as for Apple							
Syneta leaf beetle	Lead arsenate	7 (combined lead)	Powder 30% D	3 lb. Thorough coverage.	Calyx and 10-14 days later if infestation is severe.			
	DDT	7	5% D	do.	do.			
Treehoppers	Mineral oil	Exempt	EC or emulsion	4% oil	Dormant.			
PINEAPPLE								
Mealybug and red scale	Parathion	1	15% WP 1% D	1 lb. 85-90 lb./acre	When infestation is found on 3 adjacent plants; check every 1-2 months.	35-40		Fla. Cir. S-36
Pineapple mite	Sulfur	Safe	D	85-90 lb./acre	When mites appear.			

FRUIT INSECTS (continued)

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Formulation per 100 gal. of water unless otherwise indicated	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
PLUM AND PRUNE								
Aphids, hop, mealy, plum, thistle, and green peach	Mineral oil	Exempt	EC or emulsion	4% oil	Dormant	—		C 270
	Nicotine	2 (nicotine)	40% nicotine soln.	3/4-1 pt. + lime	When aphids first appear.	3		
	Parathion	1	15% WP	1 lb.	do.	14		
	Malathion	8	25% WP	2 lb.	do.	3		
	Demeton	—	EC(2 lb./gal.)	½-1 pt.	do.	—	Use only on non-bearing trees or after harvest.	
Borers	. . . . Same as for Peach							
Eye-spotted bud moth	Lead arsenate	7 (combined lead)	Powder	3 lb.	Just as tips of leaves are pushing out from buds; if infestation is serious, repeat in 7-10 days.			C 270

TREE-NUT INSECTS

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Formulation per 100 gal. of water unless otherwise indicated	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
CHESTNUT								
Weevils	DDT	—	50% WP	4 lb.	3 weekly, beginning about August 15.			L 384
	Ethylene dibromide	—	40% soln.	1 cc./sq. ft.	Inject to depth of 5 in. after larvae enter soil.			
Mites	Aramite	—	15% WP	2 lb.	When mites appear in numbers.			
	Malathion	—	25% WP	2 lb.	do.			
FILBERT								
Filbert worm	Lead arsenate	—	Powder	3 lb.	About middle of July and 3 weeks later.			C 270, L 384
	DDT	—	50% WP	2 lb.	do.			
PECAN								
Black pecan aphid	Nicotine sulfate	—	40% nicotine soln. +	½ pt. +	When yellow spots appear on foliage.		—	FB 1829
	+ summer oil or	—	EC or emulsion or	2 qt. or				
	bordeaux mixture	—	tank mix	2-1-100 or as for Pecan scab				
	Parathion	—	15% WP	1 lb.	do.		—	
			1% D	Cover trees thoroughly			—	
			25% WP	4 lb./5 gal./acre			Apply by airplane.	
	TEPP	—	40% EC	1 pt./5 gal./acre	do.		do.	
Curculio	BHC (gamma)	—	10% gamma WP	4 lb.	When buds show 1/4-1 in. of green growth.			
	Lindane	—	25% WP	1½ lb.	do.			
Fall webworm	Lead arsenate	—	Powder	3 lb.	When webs become numerous and caterpillars are still small.		Use with 2-1-100 bordeaux mixture.	
	Calcium arsenate	—	Powder	3 lb.			do.	
	DDT	—	50% WP	2 lb.	do.		—	

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Formulation per 100 gal. of water unless otherwise indicated	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
PECAN (con.)								
May beetle	Lead arsenate	—	Powder	4 lb.	In spring when beetles are first noticed.		Use with 2-1-100 bordeaux mixture.	FB 1829
	DDT	—	50% WP	2 lb.	do.		—	
	Parathion	—	15% WP	2 lb.	do.		—	
Mites	Parathion	—	15% WP	1 lb.	When mites appear in numbers and, if infestation is heavy, repeat in about 10 days.			
	Sulfur	Safe	WP	4 lb.	Add to parathion spray if species other than *Tetranychus hicoriae* are present.			
Obscure scale	Mineral oil	Exempt	EC or emulsion	2-3% oil	Dormant.			
Pecan leaf casebearer	DDT	—	50% WP	2 lb.	When buds begin to open or near end of July.		—	
	Parathion	—	15% WP	2 lb.	do.		—	
	Lead arsenate	—	Powder	3 lb.	do.		Use with 2-1-100 bordeaux mixture.	
Pecan nut casebearer	DDT	—	50% WP	2-3 lb.	1-2 applications 7 days apart, between about April 20 and May 15, or when tips of nuts turn brown.		—	
	Parathion	—	15% WP	2 lb.			—	
	Nicotine sulfate + summer oil	—	40% nicotine soln. + EC or emulsion	13 fl. oz. + 2 qt.			—	
	Lead arsenate	—	Powder	6 lb.	do.		Do not use in humid areas.	
Pecan phylloxera	Nicotine sulfate + lime sulfur or summer oil	— Safe Exempt	40% nicotine soln. + 30-32° Be. or EC or emulsion	3/4 pt. + 2½ gal. or 2 qt.	Delayed dormant, or until buds show 1-2 in. of growth.			
	BHC (gamma)	—	10% gamma WP	2½ lb.	do.			
	Lindane	—	25% WP	1¼ lb.	do.			

Pecan phylloxera continued on page 83.

TREE-NUT INSECTS (continued)

Crop and insect	Insecticide	Tolerance (p.p.m.)	Formulation	Formulation per 100 gal. of water unless otherwise indicated	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
PECAN (con.)								
Pecan phylloxera (con.)	Dinitrobutylphenol	—	36% EC	3 qt.	Late February until buds begin to swell.			FB 1829
	Dinitrocyclohexylphenol + mineral oil	— Exempt	40% WP + EC or emulsion	2 lb. + 2%	do.			
Pecan weevil	DDT	—	50% WP	6 lb.	When at least 6 weevils can be jarred from any tree, and 10-14 days later.			
	Toxaphene	—	40% WP EC (8 lb./gal.)	6 lb. $2\frac{1}{2}$ pt.				
Spittlebug	Parathion	—	15% WP	2 lb.	About time first leaves are half grown.			
	Nicotine sulfate + summer oil	— Exempt	40% nicotine soln. + EC or emulsion	3/4 pt. + 3 qt.	do.			
Twig girdler	DDT	—	50% WP	4 lb.	3 at 2-week intervals when first injured branches are noted.			
	Parathion	—	15% WP	3 lb.				
Walnut caterpillar	. . . . Same as for Fall webworm on pecan							
WALNUT								
Walnut aphid	Nicotine sulfate	—	40% nicotine soln.	$\frac{1}{2}$ pt. + soap or spreader	When aphids appear.			C 270
			2% D	Cover tree thoroughly.	do.			
Walnut caterpillar	. . . . Same as for Fall webworm on pecan							

COTTON INSECTS

Insect	Insecticide	Tolerance (cottonseed) (p.p.m.)	Formulation	Dosage (Pounds of insecticide per acre unless otherwise indicated)	Application (As needed unless otherwise indicated)	Restrictions		References
						Min. days from last application to hand picking	Other	
Boll weevil	Aldrin	—	EC or D	0.25-0.75	Every 3-5 days until controlled.	5		Conference Report on Cotton Insects
	BHC (gamma)	—	EC or D	0.30-0.45	do.	—		
	Calcium arsenate	—	D	7-10	do.	—		
	Chlordane	—	EC or D	1.0-1.5	do.	—		
	Chlorthion	—	EC or D	0.3-1.0	do.	—		
	Dieldrin	—	EC or D	0.15-0.50	do.	5		
	Endrin	0	EC or D	0.2-0.5	do.	5*		
	Heptachlor	0.1	EC or D	0.25-0.75	do.	5		
	Methyl parathion	—	EC or D	0.25-0.50	do.	15		
	Toxaphene	—	EC or D	2-3	do.	—		
Bollworm	Calcium arsenate	—	D	12-15	Every 5-7 days until controlled.	—		
	DDT	—	EC or D	0.5-1.5	do.	—		
	Endrin	0	EC or D	0.2-0.5	do.	5*		
	Toxaphene	—	EC or D	2-4	do.	—		
Cotton aphid	BHC (gamma)	—	EC or D	0.3-0.6		—		
	Chlorthion	—	EC or D	0.25-0.5		—		
	Demeton	—	EC	0.125-0.4		5		
	Malathion	—	EC or D	0.4-0.75		—		
	Methyl parathion	—	EC or D	0.25-0.50		15		
	Parathion	—	EC or D	0.1-0.25		5		
Cotton fleahopper	Aldrin	—	EC or D	0.2	2-4 weekly.	5		
	BHC (gamma)	—	EC or D	0.1	do.	—		
	Chlordane	—	EC or D	0.2	do.	—		
	DDT	—	EC or D	0.5	do.	—		
	Dieldrin	—	EC or D	0.1	do.	5		
	Endrin	0	EC or D	0.08-0.15	do.	5*		
	Heptachlor	0.1	EC or D	0.2	do.	5		
	Toxaphene	—	EC or D	0.75-1.0	do.	—		
Cotton leafworm	Calcium arsenate	—	D	7-10		—		
	Chlorthion	—	EC or D	0.25-0.5		—		
	Endrin	0	EC or D	0.2-0.5		5*		
	Malathion	—	EC or D	0.25-0.5		—		
	Methyl parathion	—	EC or D	0.25-0.5		15		
	Parathion	—	EC or D	0.125		5		
	Toxaphene	—	EC or D	1.5-2.0		—		
Cutworms	DDT**	—	EC or D	1-2		—		
	Dieldrin	—	EC or D	0.3-0.5		5		
	Endrin	0	EC or D	0.2-0.5		5*		
	Toxaphene	—	EC or D	2-4		—		

* Workers entering fields within 5 days after application should be protected.

** Does not control all species.

COTTON INSECTS (continued)

Insect	Insecticide	Tolerance (cotton-seed) (p.p.m.)	Formulation	Dosage (Pounds of insecticide per acre unless otherwise indicated)	Application (As needed unless otherwise indicated)	Restrictions		References
						Min. days from last application to hand picking	Other	
Fall armyworm	Aldrin	—	EC or D	0.25-0.5		5		Conference Report on Cotton Insects
	BHC (gamma)	—	EC or D	0.4-0.6		—		
	Chlordane	—	EC or D	1.5-2.0		—		
	DDT	—	EC or D	0.5-1.0		—		
	Dieldrin	—	EC or D	0.2-0.3		5		
	Endrin	0	EC or D	0.2-0.3		5*		
	Toxaphene	—	EC or D	2.0-2.5		—		
Lygus and other mirids	Aldrin	—	EC or D	0.25-0.75		5		
	BHC (gamma)	—	EC or D	0.30-0.45		—		
	Chlordane	—	EC or D	1.0-1.5		—		
	Chlorthion	—	EC or D	0.3-1.0		—		
	DDT	—	EC or D	1.0-1.5		—		
	Dieldrin	—	EC or D	0.15-0.50		5		
	Endrin	0	EC or D	0.2-0.5		5*		
	Heptachlor	0.1	EC or D	0.25-0.75		5		
	Toxaphene	—	EC or D	2-3		—		
Pink bollworm	DDT	—	EC or D	2-3	Every 7 days until insects are controlled or until harvest.			Also L 339
Grasshoppers	Aldrin	—	EC or D	0.10-0.25		5		
	BHC (gamma)	—	EC or D	0.3-0.5		—		
	Chlordane	—	EC or D	0.5-1.5		—		
	Dieldrin	—	EC or D	0.07-0.125		5		
	Endrin	0	EC or D	0.2-0.5		5*		
	Heptachlor	0.1	EC or D	0.25-0.50		5		
	Toxaphene	—	EC or D	1.0-2.5		—		
Spider mites	Aramite	—	EC or D	0.33-1.0		—		
	Chlorthion**	—	EC or D	0.25-0.50		—		
	Demeton	—	EC	0.125-0.4		5		
	Malathion**	—	EC or D	0.25-0.75		—		
	Methyl parathion**	—	EC or D	0.25-0.50		15		
	Parathion**	—	EC or D	0.1-0.4		5		
	Sulfur**	Safe	D	20-60		—		
Stink bugs	BHC (gamma)	—	EC or D	0.5		—		
	Dieldrin	—	EC or D	0.5		5		
	Heptachlor	0.1	EC or D	1		5		
	Toxaphene	—	EC or D	6		—		

*Workers entering fields within 5 days after application should be protected.

**Does not control all species.

COTTON INSECTS (continued)

Insect	Insecticide	Tolerance (cottonseed) (p.p.m.)	Formulation	Dosage (Pounds of insecticide per acre unless otherwise indicated)	Application (As needed unless otherwise indicated)	Restrictions		References
						Min. days from last application to hand picking	Other	
Thrips	Aldrin	—	EC or D	0.08-0.15	1-4 at 7-day intervals early in season.	5		Conference Report on Cotton Insects
	BHC (gamma)	—	EC or D	0.1-0.2		—		
	Chlordane	—	EC or D	0.5-1.0	do.	—		
	Chlorthion	—	EC or D	0.375	do.	—		
	DDT	—	EC or D	0.25-1.50	do.	—		
	Dieldrin	—	EC or D	0.05-0.15	do.	5		
	Endrin	0	EC or D	0.08-0.15	do.	5*		
	Heptachlor	0.1	EC or D	0.08-0.15	do.	5		
	Toxaphene	—	EC or D	0.75-1.0	do.	—		
Beet armyworm	DDT	—	EC or D	1.0-1.5				
	Toxaphene	—	EC or D	2-4				
Cotton leaf perforator	DDT	—	EC or D	1.5-3.0		—		
	Endrin	0	EC or D	0.4-0.5		5*		
	Methyl parathion	—	EC or D	0.5		15		
	Parathion	—	EC or D	0.5		5		
False wireworms								
Adults on young plants	Aldrin	—	EC	0.5		5		
	Chlordane	—	5% D	20 lb. of dust		—		
	DDT	—	EC	1-2		—		
	Dieldrin	—	EC	0.25		5		
	Toxaphene	—	EC	1-2		—		
Larvae on seedlings	Aldrin	—	Slurry with suitable fungicide	2 oz./100 lb. seed		5		
	Dieldrin	—	do.	do.		5		
	Endrin	0	do.	do.		5*		
	Heptachlor	0.1	do.	do.		5		
	Lindane	—	do.	do.		—		
Field cricket	Aldrin	—	2.5% D	20-30 lb. of dust		5		
	Chlordane	—	5% D	20-25 lb. of dust		—		
	DDT	—	10% D	20-25 lb. of dust		—		
	Dieldrin	—	2.5% D	20-30 lb. of dust		5		
Garden webworm	DDT	—	EC or D	1		—		
	Dieldrin	—	EC or D	0.3		5		
	Endrin	0	EC or D	0.3		5*		
	Heptachlor	0.1	EC or D	0.4		5		
	Parathion	—	EC or D	0.15		5		
	Toxaphene	—	EC or D	3		—		

*Workers entering fields within 5 days after application should be protected.

COTTON INSECTS (continued)

Insect	Insecticide	Tolerance (cotton-seed) (p.p.m.)	Formulation	Dosage (Pounds of insecticide per acre unless otherwise indicated)	Application (As needed unless otherwise indicated)	Restrictions		References
						Min. days from last application to hand picking	Other	
White-fringed beetle	Aldrin	—	EC, WP, D, or G	Broadcast 3 lb. In drill row 3/4 lb.		5		Conference Report on Cotton Insects
	Chlordane	—	EC, WP, D, or G	Broadcast 5 lb. In drill row 1 lb.		—		
	DDT	—	EC, WP, D, or G	Broadcast 10 lb. In drill row 2 lb.		—		
	Dieldrin	—	EC, WP, D, or G	Broadcast 1½ lb. In drill row ½ lb.		5		
	Heptachlor	0.1	EC, WP, D, or G	Broadcast 3 lb. In drill row 3/4 lb.		5		
Whiteflies	Malathion	—	EC or D	0.25-0.75		—		
	Parathion	—	EC or D	0.125-0.5		5		
Yellow-striped armyworm	DDT	—	EC	1		—		
	Dieldrin	—	3% D EC	15 lb. of dust 0.30-0.45 lb.		5		
	EPN	0.5	EC	0.3		21		
	Toxaphene	—	EC 20% D	2-3 15 lb. of dust		—		
Brown cotton leafworm	Endrin	0	EC or D	0.33		5*		
	Malathion	—	EC or D	0.25		—		
	Parathion	—	EC or D	0.125		5		
Cabbage looper	Endrin	0	EC or D	0.4-0.5		5*		
Flea beetles	Aldrin	—	EC or D	0.25-0.5		5		
	Chlordane	—	EC or D	0.5		—		
	DDT	—	EC or D	1		—		
	Dieldrin	—	EC or D	0.25-0.33		5		
	Toxaphene	—	EC or D	2-3		—		
Greenhouse leaf tier	Endrin	0	EC or D	0.4		5*		
Potato leafhopper and Southern garden leafhopper	DDT	—	EC or D	1-1.5		—		
	Malathion	—	EC or D	0.75		—		
	Parathion	—	EC or D	0.25-0.5		5		
Leafrollers	DDT	—	EC or D	2-3		—		
	Parathion	—	EC or D	1		5		
Salt-marsh caterpillar	Endrin	0	EC	0.4-0.5		5*		
	Parathion	—	EC or D	0.5-1.0		5		
Serpentine leaf miner	Chlorthion	—	EC or D	0.25-0.5		—		
	Parathion	—	EC or D			5		

*Workers entering fields within 5 days after application should be protected.

LIVESTOCK INSECTS

Precautions.--In applying insecticides to livestock or around barns, do not contaminate feed, feed and water troughs, or allow runoff into streams. Observe all other precautions specified on the inside of the front cover.

Animal and insect	Insecticide	Tolerance (p.p.m.)	Formulation and strength	Dosage (Dilute material per animal unless otherwise indicated)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
CATTLE								
Beef or dairy								
Cattle grubs	Rotenone	—	5% D	3 oz.	Rub thoroughly on back.			FB 1596
			5% D (7½ lb./ 100 gal. water)	2-4 qt.	Wash or apply with power sprayer 1-3 times to backs every 30 days.			
Horn flies	Methoxychlor	3 (in fat)	EC or WP, 0.5% S	2 qt.	To backs at intervals of 3 weeks or more.			L 270, 283, 291, 338, 388
			50% WP	1 tbsp.	do.			
			5% oil soln.	1 gal./20 ft. of cable	Saturate back rubbers.			
	Pyrethrins + synergist	—	0.05% + 0.5% S	1-2 qt.	As wet spray every 3-7 days.			
			Oil soln. or EC, 1% + 10% S	1-2 oz.	As mist spray daily, by hand or with treadle sprayer.			
Horse flies, stable flies, and mosquitoes	Pyrethrins + synergist, alone or with methoxychlor or organic thiocyanate		0.05-0.1% + 0.5-1.0% S	1-2 qt.	As wet spray every 2-3 days.			L 283, 338
			Oil soln. or EC, 1% + 10% S	1-2 oz.	As mist spray, same as for horse flies.			
Lice	Lindane	—	EC or WP, 0.025-0.05%	Amount of all insecticides will vary with size of animal and amount of hair.	Spray animals thoroughly.		Do not exceed 0.03% concentration on calves less than 6 months old.	L 319, FB 909
			1% D		Dust animals thoroughly.			
	Methoxychlor	3 (in fat)	EC or WP, 0.5% (1-1.5% for tail louse)		Immerse or spray animals thoroughly.			
			10% D		Dust animals thoroughly.			
	Pyrethrins + synergist	—	0.025% + 0.25% S		Spray animals thoroughly.			
	Rotenone	—	0.006% S		do.			
			0.5-1% D		Dust animals thoroughly.			

Animal and insect	Insecticide	Tolerance (p.p.m.)	Formulation and strength	Dosage (Dilute material per animal unless otherwise indicated)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
CATTLE (con.)								
Beef or dairy (con.)								
Screw-worms	Diphenylamine	—	35% (Smear 62)	—	Brush or smear on wound and surrounding area, twice first week and weekly thereafter until healed.			E-813
	Lindane	—	3% (EQ-335)	Minimum amount necessary to treat wound. Do not use more than 3 tsp. on baby calves.				
Ticks	Arsenic (As_2O_3)	—	0.175–0.19% soln.	Amount of all these materials will vary with size of animals and amount of hair.	Immerse animals every 14 days.			FB 1057
	Lindane	—	EC or WP, 0.025–0.05%		As needed; immerse or spray animals thoroughly.		Do not exceed 0.03% concentration on calves less than 6 months old.	EC 10
	Pyrethrins + synergist		0.1% + 1% S		do.			
	Rotenone	—	5% D (12 oz./gal. water)		As needed; spray animals thoroughly.			
Spinose ear tick	Lindane	—	0.75% in xylene-pine oil	½ oz.	Inside ears with spring-bottom oiler.			FB 980
Beef								
Horn flies	DDT or TDE	—	EC or WP, 0.5% S* 50% D 5% oil soln.	2 qt. 1 tbsp. 1 gal./20 ft. of cable	Every 3 weeks. do. Saturate back rubbers.			L 270, 283, 291, 338, 388, E-880
	Toxaphene	—	EC or WP, 0.5% S 50% D	2 qt. 1 tbsp.	Every 3 weeks. do.			

*If higher concentrations are used, decrease the amount per animal proportionally.

LIVESTOCK INSECTS (continued)

Animal and insect	Insecticide	Tolerance (p.p.m.)	Formulation and strength	Dosage (Dilute material per animal unless otherwise indicated)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
CATTLE (con.)								
Beef (con.)								
Lice	Lindane or BHC (gamma)	—	EC or WP, 0.03% S	Amount of all these materials will vary with size of animals and amount of hair.	Spray animals thoroughly; repeat after 2-3 weeks if needed.		Do not exceed 0.03% on calves less than 6 months old.	L 319, FB 909, E-880, EC-10
	Chlordane, TDE, or toxaphene	—	EC or WP, 0.5% S		do.		—	
	DDT	—	EC or WP, 0.25% dip, 0.5% S (1-1.5% S for tail louse)		Immerse or spray animals thoroughly; repeat after 2-3 weeks if necessary.		—	
			10% D		Cover animals thoroughly.		—	
Ticks	DDT	—	EC, 0.5%	Amount of all these materials will vary with size of animals and amount of hair.	Immerse or spray animals thoroughly; repeat as needed.		For spinose ear tick apply sprays at low pressure so as not to injure inner ear.	EC-10, E-880
	DDT + lindane or BHC (gamma)	—	EC or WP, 0.5% + 0.025%					
	Toxaphene	—	EC, 0.5%		do.		Do not overdose, especially on calves.	
SHEEP AND GOATS								
Fleeceworms	Lindane	—	3% (EQ 335)		Wet infested area and 3 in. around it.			E-813
Lice	Chlordane, DDT, TDE, or toxaphene	—	EC or WP, 0.25% dip, 0.5% S	Amount of all these materials will vary with size of animals and amount of hair.	Immerse or spray animals thoroughly; repeat after 2-3 weeks if necessary.		Do not use on milk goats.	L-308
	Lindane or BHC (gamma)	—	EC or WP, 0.025% dip, 0.05% S		do.		Do not use on emaciated or lactating animals.	
	Methoxychlor	—	EC or WP, 0.25% dip, 0.5% S		do.		—	
	Rotenone	—	0.006% S		do.		—	
			0.5-1.0% D		Dust animals thoroughly; repeat after 2-3 weeks if necessary.			

LIVESTOCK INSECTS (continued)

Animal and insect	Insecticide	Tolerance (p.p.m.)	Formulation and strength	Dosage (Dilute material per animal unless otherwise indicated)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
SHEEP AND GOATS (con.)								
Screw-worms	Diphenylamine	—	35% (Smear 62)		Brush or smear on wound and surrounding area, twice first week and weekly thereafter until healed.		Use minimum amount necessary to treat wound.	E-813
	Lindane	—	3% (EQ 335)					
Ticks and keds (sheep tick)	Lindane or BHC (gamma)	—	EC or WP, 0.25% dip, 0.05% S	Amount of all these materials will vary with size of animals and amount of hair.	Immerse or spray animals thoroughly; repeat as needed.		Do not use on emaciated or lactating animals.	EC-10, E-880, FB 2057
	DDT or toxaphene	—	EC or WP, 0.25% dip, 0.05% S		do.		Do not use on milk goats.	
	Pyrethrins + synergist	—	0.1% + 1.0%		do.		—	
	Rotenone	—	5% D (12 oz./gal. water)		do.		—	
SWINE								
Lice	Lindane or BHC (gamma)	—	EC or WP, 0.05-0.06% dip or S	Amount of all these materials will vary with size of animals and amount of hair.	Immerse or spray animals thoroughly; repeat after 2-3 weeks if necessary.			L 316, FB 1085
	Chlordane, DDT, TDE, or toxaphene	—	EC or WP, 0.5%		do.			
	Methoxychlor	3 (in fat)	EC or WP, 0.5%		—			
	DDT	—	10% D		Cover animals thoroughly.			
	Lindane or BHC (gamma)	—	1% D		do.			

LIVESTOCK INSECTS (continued)

Animal and insect	Insecticide	Tolerance (p.p.m.)	Formulation and strength	Dosage (Dilute material per animal unless otherwise indicated)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
POULTRY								
Lice	Lindane or BHC (gamma)	—	EC or WP, 0.5-1%		Spray or paint, covering house, roost, and nests thoroughly.		Do not apply on birds or while birds are in house.	L-366, FB-1652
	Nicotine sulfate	—	40% nicotine soln.	1 pt./150-200 ft. of roost	Paint on roosts only.		do.	
	Malathion	—	1% roost paint	1 pt./150 ft. of roost	Thorough coverage of house, roosts, and nests. Replace nesting material after spraying.		do.	
			4% D	1 lb./40 sq. ft. of litter				
	DDT	—	5-10% D	1 lb./100 birds	—		do.	
	Rotenone	—	1% D	do.	—		do.	
	Sodium fluoride	—	100% D	do.	Pinch method.		do.	
			1 oz./gal. water		Immerse birds.			
	Sodium fluosilicate	—	do.	do.	do.		do.	
Mites	Lindane or BHC (gamma), nicotine sulfate or malathion	. . . . Same as for Lice					do.	L 383, FB 1652
	Sulfur	Safe	1-2 oz./gal. water	—	Immerse birds.		do.	
			100% D		Cover birds thoroughly.			
Fowl tick	Lindane or BHC (gamma), chlordane, or toxaphene	—	0.5% S		Thorough coverage of houses, roosts, and nests.			L 382, FB 1652
	DDT	—	5% S		do.			

Insect	Insecticide	Tolerance (p.p.m.)	Formulation and strength	Dosage (Dilute material per 1000 sq. ft. for surfaces and per 1000 cu. ft. for space sprays)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
INFESTED AREAS								
House flies and stable flies								
In barns	Bayer L 13/59	—	1-2% dry B	1 oz.	Broadcast daily for 3 days; as needed thereafter.		Do not use in milk-rooms or contaminate animal feed or water.	L 390, EC-29
			0.1% liquid B	1 gal.	Sprinkle daily for 3 days; as needed thereafter.		do.	
	Diazinon	—	EC or WP, 1% S	1-2 gal.	Thorough coverage of resting surfaces.		do.	
	Lindane or BHC (gamma)	—	EC or WP, 0.3-0.5% S	1 gal.	do.		do.	
	Malathion	—	1-2% dry B	1 oz.	Broadcast daily for 3 days; as needed thereafter.		do.	
			EC or WP, 1% S	1-2 gal.	Thorough coverage of resting surfaces.		do.	
	Methoxychlor	—	EC or WP, 2.5-5.0% S	1-2 gal. 1-2 oz.	do. Space spray.		—	
	Pyrethrins + synergist	—	0.1-0.2% + 1-2% S	1-2 oz.	do.		—	
Outside barns	Chlordane	—	EC or WP, 2.0-2.5% S	1-2 gal.	Thorough coverage of exterior surfaces, vegetation, manure, and refuse.		Do not use in dairy barns.	L 182, 283, 338, 390
	DDT	—	EC or WP, 2-5%	½-2 gal.	Thorough coverage of resting places or space spray.			
	Toxaphene	—	EC or WP, 5%		Thorough coverage of resting places.			

LIVESTOCK INSECTS (continued)

Insect	Insecticide	Tolerance (p.p.m.)	Formulation and strength	Dosage (Insecticide per acre)	Application	Restrictions		References
						Min. days from last application to harvest or feeding	Other	
INFESTED AREAS (con.)								
Chiggers	Chlordane or toxaphene	—	EC or WP, 1% S 5% D	2 lb.	Spray or dust at 4-8 week intervals or as needed.		Keep birds out of treated area for at least 2 days.	L 302, 383, 403
	Lindane or BHC (gamma)	—	1% S or D	½ lb.	do.		do.	
Ticks	Chlordane, dieldrin, or toxaphene	—	EC or WP, 1% S 5 or 10% D	1-4 lb.	1 or 2 annually.			L 387
	DDT	—	1% S 10% D	1-4 lb.	As needed.			
	Lindane or BHC (gamma)	—	EC or WP, 0.1% S 1% D	0.2-0.4 lb.	do.			
Ants	Aldrin, dieldrin, or chlordane	—	EC or WP, 0.25%	1-2 lb. 2-4 lb. (chlordane)	Thorough drenching of nests.			L 350
	Aldrin	—	2.5% D	1-2 lb.	Thorough coverage of soil around plants.			
	Dieldrin	—	1.5% D	1-2 lb.				
	Chlordane	—	5% D	2-4 lb.	do.			

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Conference Report on Cotton Insect Research and Control, Memphis, Tenn., Dec. 12-14, 1955, Entomology Research Branch in cooperation with 16 cotton-growing States.

U. S. GOVERNMENT PRINTING OFFICE : 1956 O - 388812

Pls. Exh. 9

pg 1698 (establishment of tolerances for **ALDRIN**)

17[illegible] - Malathion

THE NATIONAL ARCHIVES OF THE UNITED STATES 1934

FEDERAL REGISTER

VOLUME 21 NUMBER 53

Washington, Saturday, March 17, 1956

TITLE 5—ADMINISTRATIVE PERSONNEL

Chapter I—Civil Service Commission

PART 6—EXCEPTIONS FROM COMPETITIVE SERVICE

DEPARTMENT OF DEFENSE

Effective upon publication in the FEDERAL REGISTER, paragraph (a) (10) of § 6.304 is revoked.

(R. S. 1753, sec. 2, 22 Stat. 403; 5 U. S. C. 631, 633)

UNITED STATES CIVIL SERVICE COMMISSION,
[SEAL] WM. C. HULL,
Executive Assistant.

[F. R. Doc. 56-2067; Filed, Mar. 16, 1956; 8:55 a. m.]

TITLE 6—AGRICULTURAL CREDIT

Chapter IV—Commodity Stabilization Service and Commodity Credit Corporation, Department of Agriculture

Subchapter B—Loans, Purchases, and Other Operations

[1955 C. C. C. Grain Price Support Bulletin 1, Supp. 3, Wheat]

PART 421—GRAINS AND RELATED COMMODITIES

SUBPART—1955-CROP WHEAT RESEAL LOAN PROGRAM

A reseal loan program has been announced for 1955-crop wheat. The 1955 C. C. C. Grain Price Support Bulletin 1 (20 F. R. 3017 and 4563), issued by Commodity Credit Corporation and containing the general requirements with respect to price support operations for grains and related commodities produced in 1955, supplemented by Supplements 1 and 2, Wheat (20 F. R. 3455, 3649 and 5997), containing the specific requirements for the 1955-crop wheat price support program, is hereby further supplemented as follows:

Sec.
421.1051 Applicable sections of 1955 CCC Grain Price Support Bulletin 1, and Supplements 1 and 2, Wheat.
421.1052 Availability.
421.1053 Eligible producer.
421.1054 Eligible wheat.
421.1055 Approved storage.
421.1056 Approved forms.
421.1057 Quantity eligible for resealing.
421.1058 Additional service charges.
421.1059 Transfer of producer's equity.
421.1060 Setoffs.
421.1061 Storage and track-loading payments.
421.1062 Maturity and satisfaction.
421.1063 Support rates.

AUTHORITY: §§ 421.1051 to 421.1063 issued under sec. 4, 62 Stat. 1070, as amended; 15 U. S. C. 714b. Interpret or apply sec. 5, 62 Stat. 1072, secs. 101, 401, 63 Stat. 1051, 1054; 15 U. S. C. 714c, 7 U. S. C. 1441, 1421.

§ 421.1051 *Applicable sections of 1955 CCC Grain Price Support Bulletin 1, and Supplements 1 and 2, Wheat.* The following sections of the 1955 CCC Grain Price Support Bulletin 1, as amended, and Supplements 1 and 2, Wheat, published in 20 F. R. 3017, 4563, 3455, 3649 and 5997, shall be applicable to the 1955 Wheat Reseal Loan Program: § 421.1001 *Administration;* § 421.1005 *Approved lending agencies;* § 421.1008 *Liens;* § 421.1011 *Interest rate;* § 421.1013 *Safeguarding the commodity;* § 421.1014 *Insurance on farm-storage loans;* § 421.1015 *Loss or damage to the commodity;* § 421.1016 *Personal liability of the producer;* § 421.1017 *Release of the commodity under loan;* § 421.1019 *Foreclosure;* § 421.1020 *Purchase of notes;* § 421.1040 *Determination of quantity.* Other sections of the 1955 CCC Grain Price Support Bulletin 1, as amended, and Supplements 1 and 2 Wheat, shall be applicable to the extent indicated in this subpart.

§ 421.1052 *Availability*—(a) *Area and scope.* The reseal program will be available in areas in the following States where ASC State committees determine that there may be a shortage of storage space and that wheat can be safely stored on farms for the period of the reseal loan: Arizona, California, Colorado, Idaho, Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Montana, Nebraska, New Mexico, New York, North Dakota, Oklahoma, Oregon, South Dakota, Texas, Utah, Washington, Wisconsin, and Wyoming. This program provides, under certain circumstances, for the extension of 1955-crop farm-

(Continued on p. 1693)

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TITLE 16—COMMERCIAL PRACTICES

Chapter I—Federal Trade Commission

[Docket 6480]

PART 13—DIGEST OF CEASE AND DESIST ORDERS

THOMAS Y. CROWELL CO.

Subpart—*Discriminating in price under section 2, Clayton Act, as amended*—Price discrimination under 2 (a): § 13.715 *Charges and price differentials:* § 13.730 *Customer classification.*

(Sec. 6, 38 Stat. 721; 15 U. S. C. 46. Interpret or apply sec. 2, 38 Stat. 730, as amended; 15 U. S. C. 13) [Cease and desist order, Thomas Y. Crowell Company, New York, N. Y., Docket 6480, Mar. 6, 1956]

This proceeding was heard by a hearing examiner upon the complaint of the Commission—charging a New York publisher of trade books, including popular fiction and non-fiction, with total gross sales for the year ending June 30, 1955, of over $1,900,000, with discriminating in price in violation of section 2 (a) of the Clayton Act, as amended, through pricing and selling books to customers it classified as "wholesalers" at greater discounts from list prices than it allowed its customers competing with them whom it classified as "institutional suppliers" or "sub-jobbers"—and an agreement between the parties providing for the entry of a consent order.

Upon this basis, the hearing examiner made his initial decision and order to cease and desist, which, by the Commission's order of March 6, 1956, became the "Decision of the Commission".

The order to cease and desist is as follows:

It is ordered, That respondent, Thomas Y. Crowell Company, a corporation, its officers, agents, representatives and employees, directly or through any corporate or other device, in connection with the publication, sale or distribution of any type or class of books, including popular fiction and nonfiction books which are commonly known as "trade books," in commerce, as "commerce" is defined, construed and understood in the Clayton Act (15 U. S. C. A., Section 15), do forthwith cease and desist from:

1. Discriminating, directly or indirectly, in the price of such books published by it by selling to any purchaser at net prices higher than the net prices charged any other purchaser competing in fact in the resale and distribution of said books.

By said "Decision of the Commission", report of compliance was required as follows:

It is ordered, That the respondent herein shall within sixty (60) days after service upon it of this order, file with the Commission a report in writing setting forth in detail the manner and form in which it has complied with the order to cease and desist.

By the Commission.

Issued: March 6, 1956.

[SEAL] JOHN R. HEIM,
Acting Secretary.

[F. R. Doc. 56-2094; Filed, Mar. 16, 1956; 8:53 a. m.]

TITLE 21—FOOD AND DRUGS

Chapter I—Food and Drug Administration, Department of Health, Education, and Welfare

Subchapter B—Food and Food Products

PART 120—TOLERANCES AND EXEMPTIONS FROM TOLERANCES FOR PESTICIDE CHEMICALS IN OR ON RAW AGRICULTURAL COMMODITIES

TOLERANCES FOR RESIDUES OF ALDRIN

A petition was filed with the Food and Drug Administration requesting the establishment of tolerances for residues of aldrin in or on certain raw agricultural commodities. LAter, the petition was amended. Tolerances requested in the amended petition are:

Zero in or on beans (including black-eyed peas and soybeans); corn, grain (including sweet, field, and popcorn); peas and cowpeas; corn forage; legumes for forage (including clover, alfalfa, soybean hay, pea hay, cowpea hay, peanut hay, and lespedeza); grain sorghum (including forage).

0.1 part per million in or on cherries; cranberries; grapes; peaches, nectarines, and mangoes; pineapple; plums and prunes; strawberries; asparagus; beets, sugar (including tops); carrots, horseradish, parsnips, radishes, and salsify root; celery; eggplant, peppers, and pimentos; melons (including cantaloups, muskmelons, watermelons, pumpkins, and winter squash); tomatoes; grains (including oats, rye, barley, wheat, and rice).

0.25 part per million in or on apples, pears, and quinces; citrus fruits (including oranges, grapefruit, lemons, limes, and tangerines); apricots; beets (garden variety, including tops), turnips (including tops), and rutabagas; broccoli, brussels sprouts, and kohlrabi; cabbage and cauliflower; collards, kale, mustard greens, spinach, and Swiss chard; cucumbers and summer squash; lettuce and endive (escarole); onions (including leeks, shallots, and garlic); peanuts; salsify tops.

0.75 part per million in or on grain forage (including barley, oats, rice, rye, and wheat straws).

Data in the petition do not show that residues of aldrin occur in or on the following crops when the pesticide chemical is applied according to directions proposed in the petition: Alfalfa, beans, black-eyed peas, clover, corn grain, corn forage, cowpeas, cowpea hay, grain sorghum, grain sorghum forage, lespedeza, peas, pea hay, peanut hay, popcorn, soybeans, soybean hay. A tolerance greater than zero is not required for these uses.

The Secretary of Agriculture has certified that this pesticide chemical is useful for the purposes for which tolerances are being established.

After consideration of the data submitted in the petition and other relevant material which show that the tolerances established in this order will protect the public health, and by virtue of the authority vested in the Secretary of Health, Education, and Welfare by the Federal Food, Drug, and Cosmetic Act (sec. 408 (d) (2), 68 Stat. 512; 21 U. S. C. 346a (d) (2)) and delegated to the Commissioner of Food and Drugs by the Secretary (21 CFR 120.7 (g)), the regulations for tolerances for pesticide chemicals in or on raw agricultural commodities (21 CFR Part 120) are amended by adding the following new section:

§ 120.135 *Tolerances for residues of aldrin.* Tolerances for residues of aldrin in or on raw agricultural commodities are established, as follows:

(a) 0.75 part per million in or on barley straw, oat straw, rice straw, rye straw, wheat straw.

(b) 0.25 part per million in or on apples, apricots, beets (garden), garden beet tops, broccoli, brussels sprouts, cabbage, cauliflower, collards, cucumbers, endive (escarole), garlic, grapefruit, kale, kohlrabi, leeks, lemons, lettuce, limes, mustard greens, onions, oranges, peanuts, pears, quinces, rutabagas, salsify tops, shallots, spinach, summer squash, Swiss chard, tangerines, turnips, turnip tops.

(c) 0.1 part per million in or on asparagus, barley grain, beets (sugar), sugar beet tops, cantaloup, carrots, celery, cherries, cranberries, eggplant, grapes, horseradish, mangoes, muskmelons, nectarines, oat grain, parsnips, peaches, peppers, pimentos, pineapple, plums and prunes, pumpkins, radishes, rice grain, rye grain, salsify root, strawberries, tomatoes, watermelon, wheat grain, winter squash.

(d) Zero in or on alfalfa, beans, black-eyed peas, clover, corn grain, corn forage, cowpeas, cowpea hay, grain sorghum, grain sorghum forage, lespedeza, peas, pea hay, peanut hay, popcorn, soybeans, soybean hay.

Any person who will be adversely affected by the foregoing order may, at any time prior to the thirtieth day from the effectice date thereof, file with the Hearing Clerk, Department of Health, Education, and Welfare, Room 5440, 330 Independence Avenue SW., Washington 25, D. C., written objections thereto. Objections shall show wherein the person filing will be adversely affected by this order, specify with particularity the provisions of the order deemed objectionable and reasonable grounds for the objections, and request a public hearing upon the objections. Objections may be accompanied by a memorandum or brief in support thereof. All documents shall be filed in quintuplicate.

Effective date. This order shall be effective upon publication in the FEDERAL REGISTER.

(Sec. 701, 52 Stat. 1055; 21 U. S. C. 371. Interprets or applies sec. 408, 68 Stat. 512; 21 U. S. C. 346a)

Dated: March 13, 1956.

[SEAL] GEO. P. LARRICK,
Commissioner of Food and Drugs.

[F. R. Doc. 56-2061; Filed, Mar. 16, 1956; 8:52 a. m.]

Pls. Exh. 9

pg 1698 (establishment of tolerances for ALDRIN

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FEDERAL REGISTER

VOLUME 21 NUMBER 53

Washington, Saturday, March 17, 1956

TITLE 5—ADMINISTRATIVE PERSONNEL

Chapter I—Civil Service Commission

PART 6—EXCEPTIONS FROM COMPETITIVE SERVICE

DEPARTMENT OF DEFENSE

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(R. S. 1753, sec. 2, 22 Stat. 403; 5 U. S. C. 631, 633)

UNITED STATES CIVIL SERVICE COMMISSION,
[SEAL] WM. C. HULL,
Executive Assistant.

[F. R. Doc. 56-2067; Filed, Mar. 16, 1956; 8:53 a. m.]

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[1955 C. C. C. Grain Price Support Bulletin 1, Supp. 3, Wheat]

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TITLE 16—COMMERCIAL PRACTICES

Chapter I—Federal Trade Commission

[Docket 6480]

PART 13—DIGEST OF CEASE AND DESIST ORDERS

THOMAS Y. CROWELL CO.

Subpart—*Discriminating in price under section 2, Clayton Act, as amended*—Price discrimination under 2 (a): § 13.715 *Charges and price differentials:* § 13.730 *Customer classification.*

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Upon this basis, the hearing examiner made his initial decision and order to cease and desist, which, by the Commission's order of March 6, 1956, became the "Decision of the Commission".

The order to cease and desist is as follows:

It is ordered, That respondent, Thomas Y. Crowell Company, a corporation, its officers, agents, representatives and employees, directly or through any corporate or other device, in connection with the publication, sale or distribution of any type or class of books, including popular fiction and nonfiction books which are commonly known as "trade books," in commerce, as "commerce" is defined, construed and understood in the Clayton Act (15 U. S. C. A., Section 15), do forthwith cease and desist from:

1. Discriminating, directly or indirectly, in the price of such books published by it by selling to any purchaser at net prices higher than the net prices charged any other purchaser competing in fact in the resale and distribution of said books.

By said "Decision of the Commission", report of compliance was required as follows:

It is ordered, That the respondent herein shall within sixty (60) days after service upon it of this order, file with the Commission a report in writing setting forth in detail the manner and form in which it has complied with the order to cease and desist.

By the Commission.

Issued: March 6, 1956.

[SEAL] JOHN R. HEIM,
Acting Secretary.

[F. R. Doc. 56-2094; Filed, Mar. 16, 1956; 8:53 a. m.]

TITLE 21—FOOD AND DRUGS

Chapter I—Food and Drug Administration, Department of Health, Education, and Welfare

Subchapter B—Food and Food Products

PART 120—TOLERANCES AND EXEMPTIONS FROM TOLERANCES FOR PESTICIDE CHEMICALS IN OR ON RAW AGRICULTURAL COMMODITIES

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A petition was filed with the Food and Drug Administration requesting the establishment of tolerances for residues of aldrin in or on certain raw agricultural commodities. Later, the petition was amended. Tolerances requested in the amended petition are:

Zero in or on beans (including black-eyed peas and soybeans); corn, grain (including sweet, field, and popcorn); peas and cowpeas; corn forage; legumes for forage (including clover, alfalfa, soybean hay, pea hay, cowpea hay, peanut hay, and lespedeza); grain sorghum (including forage).

0.1 part per million in or on cherries; cranberries; grapes; peaches, nectarines, and mangoes; pineapple; plums and prunes; strawberries; asparagus; beets, sugar (including tops); carrots, horseradish, parsnips, radishes, and salsify root; celery; eggplant, peppers, and pimentos; melons (including cantaloups, muskmelons, watermelons, pumpkins, and winter squash); tomatoes; grains (including oats, rye, barley, wheat, and rice).

0.25 part per million in or on apples, pears, and quinces; citrus fruits (including oranges, grapefruit, lemons, limes, and tangerines); apricots; beets (garden variety, including tops), turnips (including tops), and rutabagas; broccoli, brussels sprouts, and kohlrabi; cabbage and cauliflower; collards, kale, mustard greens, spinach, and Swiss chard; cucumbers and summer squash; lettuce and endive (escarole); onions (including leeks, shallots, and garlic); peanuts; salsify tops.

0.75 part per million in or on grain forage (including barley, oats, rice, rye, and wheat straws).

Data in the petition do not show that residues of aldrin occur in or on the following crops when the pesticide chemical is applied according to directions proposed in the petition: Alfalfa, beans, black-eyed peas, clover, corn grain, corn forage, cowpeas, cowpea hay, grain sorghum, grain sorghum forage, lespedeza, peas, pea hay, peanut hay, popcorn, soybeans, soybean hay. A tolerance greater than zero is not required for these uses.

The Secretary of Agriculture has certified that this pesticide chemical is useful for the purposes for which tolerances are being established.

After consideration of the data submitted in the petition and other relevant material which show that the tolerances established in this order will protect the public health, and by virtue of the authority vested in the Secretary of Health, Education, and Welfare by the Federal Food, Drug, and Cosmetic Act (sec. 408 (d) (2), 68 Stat. 512; 21 U. S. C. 346a (d) (2)) and delegated to the Commissioner of Food and Drugs by the Secretary (21 CFR 120.7 (g)), the regulations for tolerances for pesticide chemicals in or on raw agricultural commodities (21 CFR Part 120) are amended by adding the following new section:

§ 120.135 *Tolerances for residues of aldrin.* Tolerances for residues of aldrin in or on raw agricultural commodities are established, as follows:

(a) 0.75 part per million in or on barley straw, oat straw, rice straw, rye straw, wheat straw.

(b) 0.25 part per million in or on apples, apricots, beets (garden), garden beet tops, broccoli, brussels sprouts, cabbage, cauliflower, collards, cucumbers, endive (escarole), garlic, grapefruit, kale, kohlrabi, leeks, lemons, lettuce, limes, mustard greens, onions, oranges, peanuts, pears, quinces, rutabagas, salsify tops, shallots, spinach, summer squash, Swiss chard, tangerines, turnips, turnip tops.

(c) 0.1 part per million in or on asparagus, barley grain, beets (sugar), sugar beet tops, cantaloup, carrots, celery, cherries, cranberries, eggplant, grapes, horseradish, mangoes, muskmelons, nectarines, oat grain, parsnips, peaches, peppers, pimentos, pineapple, plums and prunes, pumpkins, radishes, rice grain, rye grain, salsify root, strawberries, tomatoes, watermelon, wheat grain, winter squash.

(d) Zero in or on alfalfa, beans, black-eyed peas, clover, corn grain, corn forage, cowpeas, cowpea hay, grain sorghum, grain sorghum forage, lespedeza, peas, pea hay, peanut hay, popcorn, soybeans, soybean hay.

Any person who will be adversely affected by the foregoing order may, at any time prior to the thirtieth day from the effectice date thereof, file with the Hearing Clerk, Department of Health, Education, and Welfare, Room 5440, 330 Independence Avenue SW., Washington 25, D. C., written objections thereto. Objections shall show wherein the person filing will be adversely affected by this order, specify with particularity the provisions of the order deemed objectionable and reasonable grounds for the objections, and request a public hearing upon the objections. Objections may be accompanied by a memorandum or brief in support thereof. All documents shall be filed in quintuplicate.

Effective date. This order shall be effective upon publication in the FEDERAL REGISTER.

(Sec. 701, 52 Stat. 1055; 21 U. S. C. 371. Interprets or applies sec. 408, 68 Stat. 512; 21 U. S. C. 346a)

Dated: March 13, 1956.

[SEAL] GEO. P. LARRICK,
Commissioner of Food and Drugs.

[F. R. Doc. 56-2081; Filed, Mar. 16, 1956; 8:52 a. m.]

Pls. Exh. 10

pg. 2464 est. of tolerances for residues of **DIELDRIN**

FEDERAL REGISTER

THE NATIONAL ARCHIVES OF THE UNITED STATES 1934

VOLUME 21 NUMBER 74

Washington, Tuesday, April 17, 1956

TITLE 5—ADMINISTRATIVE PERSONNEL

Chapter I—Civil Service Commission

PART 6—EXCEPTIONS FROM COMPETITIVE SERVICE

DEPARTMENT OF DEFENSE

Effective upon publication in the FEDERAL REGISTER, paragraph (b) (1) of § 6.107 is amended as set out below.

§ 6.107 *Department of the Air Force.* * * *

(b) *Office of the Inspector General.* (1) Until June 30, 1956, in order to provide civilian personnel complementary to military personnel, five Special Agent positions in the Office of the Assistant for Security, Plans and Policy, Deputy Inspector General, the Inspector General; five Special Agent positions in offices of the Office of Special Investigations overseas; and a total of 100 Special Agent positions in the Directorate of Special Investigations, the United States Air Force Special Investigations School (OSI) and the District Offices of the Office of Special Investigations, United States Air Force, in grades GS-11 or above.

(R. S. 1753, sec. 2, 22 Stat. 403; 5 U. S. C. 631, 633)

UNITED STATES CIVIL SERVICE COMMISSION,
[SEAL] WM. C. HULL,
Executive Assistant.

[F. R. Doc. 56-2934; Filed, Apr. 16, 1956; 8:48 a. m.]

PART 6—EXCEPTIONS FROM COMPETITIVE SERVICE

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

Effective upon publication in the FEDERAL REGISTER, paragraph (a) (2) of § 6.314 is amended and paragraph (a) (12) is added as set out below.

§ 6.314 *Department of Health, Education, and Welfare*—(a) *Office of the Secretary.* * * *

(2) One Confidential Assistant to the Secretary.

* * * * *

(12) One Assistant Legislative Liaison Officer.

(R. S. 1753, sec. 2, 22 Stat. 403; U. S. C. 631, 633)

UNITED STATES CIVIL SERVICE COMMISSION,
[SEAL] WM. C. HULL,
Executive Assistant.

[F. R. Doc. 56-2935; Filed, Apr. 16, 1956; 8:48 a. m.]

PART 6—EXCEPTIONS FROM COMPETITIVE SERVICE

UNITED STATES INFORMATION AGENCY

Effective upon publication in the FEDERAL REGISTER, paragraph (e) of § 6.324 is revoked and paragraph (h) is added as set out below.

§ 6.324 *United States Information Agency.* * * *

(h) One Staff Assistant to the Chief, Office of Research and Intelligence.

(R. S. 1753, sec. 2, 22 Stat. 403; 5 U. S. C. 631, 633)

UNITED STATES CIVIL SERVICE COMMISSION,
[SEAL] WM. C. HULL,
Executive Assistant.

[F. R. Doc. 56-2962; Filed, Apr. 16, 1956; 8:53 a. m.]

TITLE 7—AGRICULTURE

Chapter I—Agricultural Marketing Service (Standards, Inspections, Marketing Practices), Department of Agriculture

PART 68—REGULATIONS AND STANDARDS FOR INSPECTION AND CERTIFICATION OF CERTAIN AGRICULTURAL COMMODITIES AND PRODUCTS THEREOF

SUBPART B—UNITED STATES STANDARDS FOR BEANS

GRADES, GRADE REQUIREMENTS, AND GRADE DESIGNATIONS

On December 31, 1955, a notice was published in the FEDERAL REGISTER (20 F. R. 10164), regarding the proposed revision of § 68.103 (d) of the United States

(Continued on p. 2463)

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Miguel D. Yalava Ranch, Route 1, Box 200, El Centro.

(b) The following premises are added to the list, contained in such instructions, of warehouses, mills, and other premises in which infestations of the khapra beetle have been determined to exist. Such premises are thereby designated as regulated areas within the meaning of said quarantine and regulations:

ARIZONA

Elva Barnes Farm, Route 1, Box 113, Gilbert.
A. R. Hunter Poultry Farm, Route 2, Box 406, Tempe.
Delbert T. Mortenson Farm, Route 1, Box 116, Gilbert.
W. J. Muse Ranch, Box 1836, Parker.
Tom Neilsen Dairy, Route 1, Box 96, Tolleson.
Lou Park's Ranch, Casa Grande.
Milton P. Smith Ranch, Route 1, Maricopa.
P. E. Sterner Farm, Box 1782, Goodyear.

CALIFORNIA

Giffen Inc. property, located at southwest corner of SW¼ of sec. 6, T. 17 S., R. 15 E. Mail address Highway 33 and Elkhorn Avenue, Cantua.

Estella Hayes Ranch (Paul Pryor, lessee), four and one-half miles west of Highway U. S. 99, south side of Olive Drive. Mail address 5501 Olive Drive, Bakersfield.

Joseph Labandera property, located one-fourth mile south of Elkhorn on Westlawn, east side of street. Mail address Box 1B6, Burrel.

San Pasqual Land & Cattle Co. property, northwest corner County Roads No. 53 and West E. Westmoreland. Mail address 316 Main Street, Brawley.

This amendment shall become effective April 17, 1956.

This amendment revokes the designation as regulated areas of certain premises, it having been determined by the Chief of the Plant Pest Control Branch that adequate sanitation measures have been practiced for a sufficient length of time to eradicate the khapra beetle in and upon such premises. It also adds additional premises to the list of premises in which khapra beetle infestations have been determined to exist, and designates such premises as regulated areas under the khapra beetle quarantine and regulations.

This amendment in part imposes restrictions supplementing khapra beetle quarantine regulations already effective. It also relieves restrictions insofar as it revokes the designation of presently regulated areas. It must be made effective promptly in order to carry out the purposes of the regulations and to permit unrestricted movement of regulated products from the premises being removed from designation as regulated areas. Accordingly, under section 4 of the Administrative Procedure Act (5 U. S. C. 1003), it is found upon good cause that notice and other public procedure with respect to the foregoing amendment are impracticable and contrary to the public interest, and good cause is found for making the effective date thereof less than 30 days after publication in the FEDERAL REGISTER.

(Sec. 9, 37 Stat. 318; 7 U. S. C. 161. Interprets or applies sec. 8, 37 Stat. 318, as amended; 7 U. S. C. 161)

Done at Washington, D. C., this 11th day of April 1956.

[SEAL] E. D. BURGESS,
Chief, Plant Pest Control Branch.

[F. R. Doc. 56-2960; Filed, Apr. 16, 1956; 8:52 a. m.]

Chapter IX—Agricultural Marketing Service (Marketing Agreements and Orders), Department of Agriculture

PART 927—MILK IN NEW YORK METROPOLITAN MARKETING AREA

SUBPART—CLASSIFICATION AND ACCOUNTING RULES AND REGULATIONS

APPROVAL OF AMENDMENT

Pursuant to the provisions of § 927.36 of Order No. 27, as amended (7 CFR Part 927), regulating the handling of milk in the New York metropolitan milk marketing area, the tentative amendment issued on April 2, 1956, by the Market Administrator of said Order No. 27, as amended, to the classification and accounting rules and regulations heretofore issued (7 CFR, 927.101 et seq.), pursuant to the provisions of said Order No. 27, as amended, is hereby approved and shall be effective on and after the first day of May 1956.

Order No. 27, as amended, requires that such rules and regulations, and amendments thereto, become effective on the first day of the month following their approval by the Secretary of Agriculture. The changes effected by this amendment to the rules and regulations to some extent tend to relieve restriction and otherwise do not require substantial or extensive preparation by handlers prior to the effective date of the amendment. Furthermore, the said tentative amendment as issued by the Market Administrator on April 2, 1956, was sent, on or about that date, to all handlers operating pool plants. In these circumstances, the time intervening between the date of approval of the tentative amendment and its effective date affords handlers a reasonable time to prepare for its effective date. It is, therefore, found and determined that May 1, 1956, herein fixed as the effective date for the said amendment, is reasonable and proper in the circumstances and that to defer the effective date of the said amendment to a date 30 days or more after publication in the FEDERAL REGISTER would be impracticable, unnecessary, and contrary to the public interest.

(Sec. 5, 49 Stat. 753, as amended; 7 U. S. C. 608c)

Done at Washington, D. C., this 12th day of April 1956.

[SEAL] ROY W. LENNARTSON,
Deputy Administrator.

[F. R. Doc. 56-2955; Filed, Apr. 16, 1956; 8:51 a. m.]

PART 927—MILK IN NEW YORK METROPOLITAN MILK MARKETING AREA

SUBPART—CLASSIFICATION AND ACCOUNTING RULES AND REGULATIONS

TENTATIVE AMENDMENT TO RULES AND REGULATIONS

Pursuant to provisions of § 927.36 of the order, as amended (7 CFR Part 927), regulating the handling of milk in the New York metropolitan milk marketing area, and of the Administrative Procedure Act (5 U. S. C. 1001 et seq.), a public meeting was held at New York, New York, on March 6, 1956, to consider proposals for the amendment of the rules and regulations heretofore issued (7 CFR § 927.101 et seq.) pursuant to said order. Notice of said public meeting was issued on February 17, 1956, and published in the FEDERAL REGISTER on March 1, 1956 (21 F. R. 1357).

After due consideration of the data, views and arguments presented by interested parties at such public meeting, the rules and regulations heretofore amended are hereby further amended, subject to the approval of the Secretary of Agriculture to read as follows:

Add to the opening sentence of § 927.203 the following: "*Provided*, That if there is not sufficient skim milk available to be assigned to all skim milk subject to the fluid skim milk differential and to fluid skim milk established to have been utilized in the standardization of cream and sour cream, fluid skim milk shall be assigned to such standardization before any is assigned to skim milk in cultured milk drinks."

(Sec. 5, 49 Stat. 753, as amended; 7 U. S. C. 608c)

Issued this 2d day of April 1956 at New York, New York.

[SEAL] C. J. BLANFORD,
Market Administrator.

[F. R. Doc. 56-2956; Filed, Apr. 16, 1956; 8:51 a. m.]

TITLE 21—FOOD AND DRUGS

Chapter I—Food and Drug Administration, Department of Health, Education, and Welfare

Subchapter B—Food and Food Products

PART 120—TOLERANCES AND EXEMPTIONS FROM TOLERANCES FOR PESTICIDE CHEMICALS IN OR ON RAW AGRICULTURAL COMMODITIES

TOLERANCES FOR RESIDUES OF DIELDRIN

A petition was filed with the Food and Drug Administration requesting the establishment of tolerances for residues of dieldrin in or on certain raw agricultural commodities. Later, the petition was amended. Tolerances requested in the amended petition are:

Zero in or on:

Beans (including black-eyed peas and soybeans).
Corn, grain (including sweet, field, and popcorn).
Corn, forage.

Dieldrin (cont.)

Melons (including cantaloups, muskmelons, watermelons, pumpkins, and winter squash).
Peas and cowpeas.
Legumes for forage (including clovers, alfalfa, soybean hay, pea hay, cowpea hay, and lespedeza).
Grain sorghum (including forage).

0.1 part per million in or on:

Cranberries.
Grapes.
Mangoes.
Plums and prunes.
Strawberries.
Asparagus.
Carrots, horseradish, parsnips, radishes (including tops), and salsify root.
Eggplant, peppers, and pimentos.
Potatoes and sweetpotatoes.
Tomatoes.
Grains (including barley, oats, rice, rye, and wheat).

0.25 part per million in or on:

Apples, pears, and quinces.
Cherries.
Citrus fruits (including oranges, grapefruit, lemons, limes, and tangerines).
Pineapple.
Beets (garden variety, including tops), turnips (including tops), and rutabagas.
Broccoli, brussels sprouts, and kohlrabi.
Cabbages and cauliflower.
Salsify tops.
Celery.
Collards, kale, mustard greens, spinach, and Swiss chard.
Cucumbers and summer squash.
Lettuce and endive (escarole).

0.75 part per million in or on:

Grain forage (including barley, oats, rice, rye, and wheat straws).

Data in the petition do not show that residues of dieldrin occur in or on the following crops when the pesticide chemical is applied according to directions in the petition: Alfalfa, beans, black-eyed peas, cantaloups, clover, corn grain, corn forage, cowpeas, cowpea hay, grain sorghum, grain sorghum forage, lespedeza, muskmelons, peas, pea hay, popcorn, pumpkins, soybeans, soybean hay, watermelons, winter squash. A tolerance greater than zero is not required for these uses.

The Secretary of Agriculture has certified that this pesticide chemical is useful for the purposes for which tolerances are being established.

After consideration of the data submitted in the petition and other relevant material which show that the tolerances established in this order will protect the public health, and by virtue of the authority vested in the Secretary of Health, Education, and Welfare by the Federal Food, Drug, and Cosmetic Act (sec. 408 (d) (2), 68 Stat. 512; 21 U. S. C. 346a (d) (2)) and delegated to the Commissioner of Food and Drugs by the Secretary (21 CFR 120.7 (g)), the regulations for tolerances for pesticide chemicals in or on raw agricultural commodities (21 CFR Part 120) are amended by adding the following new section:

§ 120.137 *Tolerances for residues of dieldrin.* Tolerances for residues of dieldrin in or on raw agricultural commodities are established, as follows:

(a) 0.75 part per million in or on barley straw, oat straw, rice straw, rye straw, wheat straw.

(b) 0.25 part per million in or on apples, beets (garden), garden beet tops, broccoli, brussels sprouts, cabbage, cauliflower, celery, cherries, collards, cucumbers, endive (escarole), grapefruit, kale, kohlrabi, lemons, lettuce, limes, mustard greens, oranges, pears, pineapple, quinces, rutabagas, salsify tops, spinach, summer squash, Swiss chard, tangerines, turnips, turnip tops.

(c) 0.1 part per million in or on asparagus, barley grain, carrots, cranberries, eggplant, grapes, horseradish, mangoes, oat grain, parsnips, peppers, pimentos, potatoes, plums and prunes, radishes, radish tops, rice grain, rye grain, salsify root, strawberries, sweetpotatoes, tomatoes, wheat grain.

(d) Zero in or on alfalfa, beans, black-eyed peas, cantaloups, clover, corn grain, corn forage, cowpeas, cowpea hay, grain sorghum, grain sorghum forage, lespedeza, muskmelons, peas, pea hay, popcorn, pumpkins, soybeans, soybean hay, watermelons, winter squash.

Any person who will be adversely affected by the foregoing order may, at any time prior to the thirtieth day from the effective date thereof, file with the Hearing Clerk, Department of Health, Education, and Welfare, Room 5440, 330 Independence Avenue SW., Washington 25, D. C., written objections thereto. Objections shall show wherein the person filing will be adversely affected by this order, specify with particularity the provisions of the order deemed objectionable and reasonable grounds for the objections, and request a public hearing upon the objections. Objections may be accompanied by a memorandum or brief in support thereof. All documents shall be filed in quintuplicate.

Effective date. This order shall be effective upon publication in the Federal Register.

(Sec. 408, 68 Stat. 511; 21 U. S. C. 346a)

Dated: April 11, 1956.

[SEAL] Geo. P. Larrick,
Commissioner of Food and Drugs.

[F. R. Doc. 56-2917; Filed, Apr. 16, 1956; 8:45 a. m.]

PART 141b—STREPTOMYCIN (OR DIHYDROSTREPTOMYCIN) AND STREPTOMYCIN- (OR DIHYDROSTREPTOMYCIN-) CONTAINING DRUGS; TESTS AND METHODS OF ASSAY

PART 146b—CERTIFICATION OF STREPTOMYCIN (OR DIHYDROSTREPTOMYCIN) AND STREPTOMYCIN- (OR DIHYDROSTREPTOMYCIN-) CONTAINING DRUGS

PART 146c—CERTIFICATION OF CHLORTETRACYCLINE (OR TETRACYCLINE) AND CHLORTETRACYCLINE- (OR TETRACYCLINE-) CONTAINING DRUGS

MISCELLANEOUS AMENDMENTS

By virtue of the authority vested in the Secretary of Health, Education, and Welfare by the Federal Food, Drug, and Cosmetic Act (sec. 507, 59 Stat. 463, 61 Stat. 11, 63 Stat. 409, 67 Stat. 389; sec. 701, 52 Stat. 1055; 21 U. S. C. 357, 371) and delegated to the Commissioner of Food and Drugs by the Secretary (20 F. R. 1996), the regulations for tests and methods of assay and certification of antibiotic and antibiotic-containing drugs (21 CFR Parts 141b, 146b, 146c) are amended as indicated below:

1. Part 141b is amended by adding the following new section:

§ 141b.130 *Streptomycin - dihydrostreptomycin for inhalation therapy*—(a) *Potency*—(1) *Total potency.* Using the dihydrostreptomycin working standard as the standard of comparison, proceed as directed in § 141b.101 (j), except if it is packaged with inert gases prepare the sample as directed in § 141b.117 (a) (1). Its total potency is satisfactory if it contains not less than 90 percent of the combined number of milligrams of streptomycin and dihydrostreptomycin that it is represented to contain.

(2) *Streptomycin content.* Proceed as directed in § 141b.118 (b). Its content of streptomycin is satisfactory if it contains not less than 45 percent and not more than 55 percent of the total potency as determined under subparagraph (1) of this paragraph.

(b) *Unless it is packaged with inert gases, toxicity, histomine, moisture, and pH.* Proceed as directed in § 141b.117 (b).

(c) *If it is packaged with inert gases, moisture.* Proceed as directed in § 141b.117 (c).

2. Part 146b is amended by adding the following new section:

§ 146b.125 *Streptomycin-dihydrostreptomycin for inhalation therapy.* (a) Streptomycin - dihydrostreptomycin for inhalation therapy conforms to all requirements and is subject to all procedures prescribed by § 146b.112 for streptomycin for inhalation therapy and dihydrostreptomycin for inhalation therapy, except that it is a mixture of equal parts of streptomycin and dihydrostreptomycin.

(b) *Exemption of streptomycin-dihydrostreptomycin for inhalation therapy from certification.* Streptomycin-dihydrostreptomycin for inhalation therapy that conforms to the requirements of paragraph (a) of this section shall be exempt from the requirements of sections 502 (l) and 507 of the act if it complies with all the following conditions:

(1) It is intended solely for veterinary use and is conspicuously so labeled.

(2) The label bears an expiration date that is not more than 48 months after the month during which the batch was last assayed and released by the manufacturer.

(3) The circular or other labeling within or attached to the package bears information that the antibiotics are for use only in the prevention or treatment of chronic respiratory disease (air-sac infection) in chickens and bears directions and warnings adequate for such use.

3. In § 146c.217 *Chlortetracycline calcium oral drops * * **, subparagraph (1) (v) of paragraph (c) *Labeling* is amended by changing the colon after the word "certified" to a comma and adding the following new clause: "except that the blank may be filled in with the date that is 18 months after the month during which the batch was certified if the per-

Pls. Exh. 11

October 9, 1956

GARY, DESMOND & PARKER
OCT 12 1956

Gary, Desmond & Parker
722 First National Bank Bldg.
Chicago 3, Illinois

Att'n.: James M. Parker

Dear Mr. Parker:

Re: Civil Action No. 2224-54
Shell v. Watson

The attempted dehydrogenations of bicycloheptene and bicycloheptane are concluded and immediately following is my report of such work.

The work was run in two phases, the first being the attempted dehydrogenation of bicycloheptene and the second being the attempted dehydrogenation of bicycloheptane.

PHASE I

Period Covered: 6-19-56 to 8-8-56

Object: To determine if bicycloheptene can be dehydrogenated to give bicycloheptadiene.

Summary. A number of experiments have been conducted to test the thesis that bicycloheptene may be catalytically dehydrogenated to give BCH (bicycloheptadiene). The catalyst and conditions which were used would be expected to encompass optimum conditions for such a dehydrogenation.

In no instance could the presence of BCH be detected in the product even though the method of work-up and analysis employed would undoubtedly have detected the formation of less than 1%. The predominant reaction was a reverse Diels-Alder to give cyclopentadiene and ethylene.

EXPERIMENTAL and DISCUSSION

A. Materials

Catalyst

A 10% platinum on 10-14 mesh activated charcoal was prepared according to a standard procedure, essentially as described by Fieser in "Experiments in Organic Chemistry", Heath & Co., 1941, p. 459.

BCH

An old sample of high-purity BCH, in storage at -10°C., was carefully fractionated and a cut 88-89°C. selected for development of the analytical method.

Bicycloheptene

The starting material was prepared by a published procedure (Charles L. Thomas, Ind. and Eng. Chem., 36, 310 (1944) and purified by fractionation to give material b.p. 94.0-96.5°C., m.p. 41.5-44.0°C. (lit. values, b.p. 94-97°C., m.p. 44-46°C.).

B. Analytical Method

The full IR scans of BCH and bicycloheptene showed several strong bands for BCH where bands of bicycloheptene were missing or very weak. A very strong BCH band at 13.7 microns which occurs on a smooth slope of the bicycloheptene band which peaks at 14.03 microns was chosen as the band for detection of BCH. Using synthetic mixtures of BCH in bicycloheptene it was found that 2% BCH exhibits a distinct peak at 13.70 microns, while 1% BCH gives a shoulder from 13.70 to 13.80 microns. For these analyses, the synthetic mixture contained the indicated weight percent of BCH in bicycloheptene; the mixture was then dissolved in an equal weight of cyclohexane. Similarly, the 84-94°C. cut of the product from each run was diluted 1:1 by weight with cyclohexane for IR analysis.

C. Apparatus

The vertical Pyrex glass reaction tube (30 in. long, 17 mm. I.D.) comprised an upper 30-cm. preheater section packed with 1/4-inch Beryl saddles above a 50-cm. catalyst section packed with 10% platinum on charcoal. The preheater and reaction zone were heated with separate "Hevi-Duty" type furnaces.

Runs 1-3

A dropping funnel fitted to the top of the reaction tube was provided with pressure equalizer tube and a nitrogen inlet with a side-connection to a mercury safety tube. Infrared lamps were used to prevent solidification of the reactant. The bottom of the reaction tube was connected to a receiver via an air-condenser. The receiver was fitted with a water condenser which led to a dry-ice cooled trap and finally, via a safety back-up trap to an inverted vessel filled with water for estimating the volume of effluent gases.

Runs 4-7

For these runs, the charge was placed in a large test tube immersed in a heating bath and the liquified bicycloheptene volatilized and swept through the catalyst in a stream of nitrogen, which was bubbled through the reactant. A rotameter was used to show the rate of nitrogen input. In run 7, wet meters were used to measure the volume of nitrogen input and the total volume of nitrogen and product gases in the effluent.

D. Procedure

In all runs, the apparatus was flushed with nitrogen and then swept with a stream of nitrogen while the preheater and catalyst bed were brought to the operating temperatures.

In runs 1-3, the nitrogen sweep was discontinued and the bicycloheptene added dropwise to give the liquid input rates shown in Table I. During these runs, the volume of non-condensable gas in the effluent was determined by displacement of water. After completion of the runs, nitrogen was again swept through the apparatus during the cooling period.

In runs 4-7, after operating temperatures had been reached, the bicycloheptene was vaporized and swept into the reaction zone by a stream of nitrogen which was bubbled through the warm reactant; in run No. 4, the reactant was kept at 74°C., and in runs 5-7, at 61°C., to give bicycloheptene pressures of 0.5 atmosphere and 0.33 atmosphere, respectively. In run 7, the volumes of nitrogen input and total gaseous output were measured in order to be able to account for the poor material balance which was found in run No. 6.

In all runs (except No. 6) the effluent condensate was fractionated through a 50-cm. spiral-wire Podbielniak column and the 84-94°C. cut submitted for IR analysis (detection) of BCH after dilution with an equal weight of cyclohexane.

E. Discussion

It was expected that six runs would be made, passing the bicycloheptene through the platinum on charcoal catalyst at 180°C., 250°C. and 320°C. - one series with, and one without a continuous nitrogen sweep. In the run with nitrogen sweep at 320°C. an unexpectedly low recovery of effluent condensate was obtained. Hence, an additional run was made in which the catalyst was weighed before and after the reaction and in which the volumes of input nitrogen and exit gases were determined; the low recovery of liquid condensate appears to be due to retention of polymeric materials in the reaction zone and to loss as gaseous product (probably primarily ethylene, since CPD was the only reaction product identified in any run).

Table I summarizes the experimental conditions and results for each run.

PHASE II

Period Covered: 8-28-56 to 10-2-56

Object: To determine if bicycloheptane can be dehydrogenated to give bicycloheptadiene.

Summary: The study of the possible formation of BCH (bicycloheptadiene) by the catalytic dehydrogenation of bicycloheptene has been extended to include the dehydrogenation of bicycloheptane.

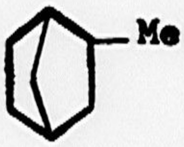
Bicycloheptane afforded a mixture of products, which included benzene and toluene, and probably cyclopentene derivatives; little, if any, bicycloheptene or cyclopentadiene was present in the product.

In no instance could BCH be detected among the products formed even though the method of work-up and analysis would have detected the formation of BCH in yields of less than 0.01%.

DISCUSSION

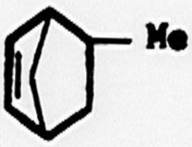
A search of the literature showed that several compounds similar to those used in this study have been subjected to dehydrogenation catalysts. For example, Zelinski, Kazansky and Plate /Ber. 66B, 1415, (1933)/ found that

2-methylbicycloheptane (I)



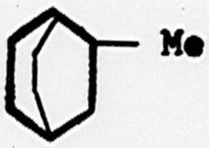
I

did not dehydrogenate on treatment with a platinum on charcoal catalyst at 300°C.; use of a hydrogen atmosphere with the same temperature and catalyst gave a mixture of cyclopentanes and a trace of m-xylene. Kazansky and Chernova [J. Gen. Chem., U.S.S.R. 8, 651, (1938)] found that 5-methyl-2-bicycloheptene (II)

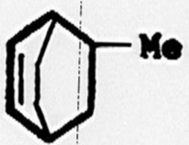


II

was not dehydrogenated with platinum on charcoal at 300°C. (nitrogen diluent) but gave polymeric materials which poisoned the catalyst (cf. run No. 7 in which the catalyst showed a substantial gain in weight). With the same catalyst at 310°C. (carbon dioxide diluent) Kazansky and Plate [Ber. 68, 1259, (1935)] found that 2-methyl-bicyclooctane (III) gave a mixture of aromatic hydrocarbons (benzene, toluene, xylene), i.e. dehydrogenation products such as IV did not survive if formed as intermediate dehydrogenation products.



III



IV

EXPERIMENTAL

A. Materials

Catalyst

The 10% platinum on charcoal catalyst was identical to that used in Runs 1-7. The catalyst was tested to ensure dehydrogenation activity by converting cyclohexane to benzene; at 300°C. the conversion was quantitative -- even with the use of only one-third the catalyst volume used in Runs 1-10.

Bicycloheptane

The starting material was prepared in 93% yield by the hydrogenation of bicycloheptene with Raney nickel catalyst in ethanol solution at 10-50 p.s.i.g.; after the reaction was essentially complete, fresh catalyst was added and the solution again pressured with hydrogen. Traces of bicycloheptene were removed by treatment with sulfuric acid and potassium permanganate. The product, b.p. 104-106°C., m.p. 86.0-86.5°C. (literature value, 86-87°C.) was free of bicycloheptene by IR (no absorbance at the strong 14.03 micron band).

B. Analytical Method

The strong BCH IR band at 13.71 microns was used as in Runs 1-7, but in the present system the sensitivity of detection is greatly increased. The plot of base-line absorbances of BCH vs. its concentrations in cyclohexane solutions showed a linear relationship and also indicated that substantial quantities of bicycloheptane did not materially affect the absorbance.

C. Apparatus and Procedure

The apparatus and method used were identical to that used in Run No. 7. Bicycloheptane was vaporized in a stream of nitrogen which was bubbled in at 25 ml. per minute, the molten reactant being kept warm enough to vaporize the charge over a period of four hours. In each run (Runs 8 to 10) a charge of 24 g. (0.25 mole) was used; for a nitrogen flow of 25 ml. per minute, this corresponds to partial pressures of ca. 0.5 atmos. for the reactant and diluent.

As before, wet meters were used in the nitrogen input line and after the dry-ice traps in order to measure the increase in volume due to gaseous products. The effluent condensates were worked up by dissolving in cyclopentane[1], drying, and fractionating in the spiral-wire Podbielniak column; as previously, the 84°-94°C. cut was checked for selective absorption at 13.71 microns.

Table II summarizes the results of experiments with bicycloheptane (labelled Runs 8-10). In Run No. 8 the recovered effluent product was essentially pure starting material; however, the formation of gaseous products as well as the increase in weight by the catalyst shows that some reaction occurred.

In Runs No. 9 and No. 10, the foreruns showed the possible presence of benzene by a strong infrared band at 14.8 microns. Benzene was positively shown to be present by the characteristic spectrum of a forerun cut in the ultraviolet region (220 to 270 mu).

In Runs No. 8 and No. 9, the 84°-94°C. cut showed no selective absorption at the analysis wavelength; however, in Run No. 10 the 84°-94°C. cut showed a small but definite selective absorption at this wavelength and indicated the possible presence of 1.32 mg. BCH in this cut or a yield of 0.0055%. This peak is probably due to toluene which exhibits a strong peak at 13.71 microns and was known to be one of the products formed.[2] It was proven conclusively that BCH did not cause the absorbance at 13.71 microns in the following manner:

A synthetic mixture containing 0.1% BCH in cyclohexane showed quantitative removal of BCH (complete disappearance of the 13.71 micron peak) by treatment with 90% (by weight) sulfuric acid. In contrast, identical treatment of the 84°-94°C. cut of Run No. 10 with 90% sulfuric acid did not affect its absorbance at 13.71 microns.

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[1] Colorimetric pentane showed a broad absorption band near the BCH analysis peak, and may have caused interference, even in the fractionated 84°-94°C. cut; cyclopentane shows no selective absorption in this region.

[2] The presence of toluene was indicated in several fractionated cuts which showed infrared peaks at one or more wavelengths corresponding to toluene peaks; it was positively identified as one of the reaction products by the characteristic absorption of a higher boiling cut in the

ultraviolet region (220 to 280 mu.).

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AWC:dr

TABLE I

Run No.	Charge of Bicyclo-heptene	Reaction time; Catalyst temp.; Preheater "	Weight of Effluent Condensate	Vol. gaseous products;[a] Wgt. ethylene equivalent	Total wgt. Recovery; % Recovery	Wgt. of 84-94°C. cut for IR Anal.	Comments
1	47.1 g. 0.5 mole	3½ hrs. 180°C. 180°C.	39.7 g.	0.ml.	39.7 g. 84%[b]	8.4 g.	Pure starting material recovered
2	"	2.7 hrs. 250°C. 180°C.	44.9 g.	443 ml. 0.020 moles 0.48 g.	45.4 g. 96%	10.2 g.	1 g. fores cut mainly CPD by IR
3	"	1.8 hrs. 320°C. 180°C.	33.6 g.	4860 ml. 0.217 moles 6.1 g.	39.7 g. 84%	8.4 g.	8.6 g. fores cut mainly CPD by IR
4	23.5 g. 0.25 mole .25 ml./min. N_2 input	6 hrs. 180°C. 180°C.	21.4 g.	Not measured	91%	4.0 g.	Pure starting material recovered
5	"	9 hrs. 250°C. 180°C.	22.8 g.	"	97%	4.2 g.	2.8 g. fores cut mainly CPD by IR
6	"	8 hrs. 320°C. 180°C.	5.0 g.	"		1.2 g.	1.8 g. fores cut mainly CPD by IR
7	"	8 hrs. 310°C. 180°C.	6.1 g.	3480 ml. 0.155 moles 4.34 g.	94% (incl. 11.8 g.gain in cat. wgt.)	1.8 g.	1.8 g.fores cut mainly CPD by IR

[a] Dry gas at 0°C.; corrected for nitrogen displacement from system.

[b] Low recovery due to leak (loss of starting material).

TABLE II

Run No.[a]	Catalyst temp.; Preheater "	Weight of Effluent Condensate	Gain in Wgt. of Cat.	Vol. gaseous products (dry gas at 0°C.); Mole % yield of gaseous products	Wgt. of 84-94°C. Cut for IR Anal.	Comments
8	325°C. 250°C.	18.4 g.[b]	2.7 g.	1.05 Liters 18 mole %	2.4 g.	Anal. cut taken up to 104°C. and is essentially pure starting material.
9	350°C. 250°C.	17.7 g.	3.6 g.	2.17 Liters 39 mole %	0.19 g.	
10	375°C. 250°C.	14.9 g.	4.3 g.	3.38 Liters 60 mole %	0.41 g.	A small peak at the anal. wavelength was not due to BCH (probably toluene).

a Continued from runs in PHASE I.

b A slight loss of starting material occurred near the beginning of the run.